



भाकृअनुप
ICAR

1993-94



INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE
(I.C.A.R.)
LIBRARY AVENUE, NEW DELHI-110012

annual report

ANNUAL REPORT

1993-94



INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE
(I.C.A.R.)

LIBRARY AVENUE, NEW DELHI-110012

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PREFACE

The present compendium gives the panorama of activities and achievements of the Institute during 1993-94. The Institute continued its mission-mode research and teaching activities through its various Divisions during the year. I hope that the information presented in this publication will be of considerable interest to the scientific fraternity. Specific suggestions for improvement in subsequent volumes of the annual reports of the Institute would be welcome.

I wish to express my thanks to the Heads of Divisions, scientists and to all other staff of IASRI for their willing support and cooperation in carrying out the functions and activities of the Institute and for providing the basic material for compilation of this report.

The efforts put in by Sh TB Jain, Head, Coordination Cell and his colleagues in compiling and editing the material of the report are commendable. Thanks are also due to Sh Mahesh Chandra, Smt. Rajni Gupta and Sh Ishwar Dutt for assistance in preparing the manuscript on Personal Computer.

OP KATHURIA
DIRECTOR

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INTRODUCTION

Aims and Functions

The Indian Agricultural Statistics Research Institute (IASRI) is a premier Institute for promoting and conducting research and training in Agricultural Statistics in the country for improving planning and evaluation of agricultural research and development. To achieve these objectives, the IASRI has the following functions :

- To conduct research in experimental designs, sampling methods, statistical genetics, bio-statistics, forecasting techniques for crops diseases and pests and statistical economics ;
- To conduct post-graduate courses leading to MSc and PhD degrees in agricultural statistics and MSc in computer application in agriculture;
- To provide advisory service to agricultural scientists/workers from various agricultural organisations in India and abroad;
- To develop computer software for agricultural research ;
- To conduct in-service training courses in agricultural statistics and computer application ; and
- To provide consultancy service in data processing.

Origin and Growth

The Institute made a modest beginning in 1930 as a small Statistical Section in the then Imperial Council of Agricultural Research to assist the State Departments of Agriculture and Animal Husbandry in planning their experiments, analysis of experimental data, interpretation of results as also rendering advice on the formulation of the technical programmes and examining the progress reports of the schemes funded by the Council. The activities of the Section increased rapidly with the appointment of Dr PV Sukhatme as Statistician to the Council in 1940 and researches were initiated for developing objective and reliable methods for collecting yield statistics of principal food crops. The efficiency and practicability of these methods were demonstrated in different states for estimating yield by crop cutting experiments. The recognition which this method attained was such that in the course of a few years, the method was extended practically to the entire country to cover all principal food and non-food crops. Research in sampling theory and training of field and statistical staff were the activities initiated in this period resulting in the re-organization of the

Statistical Section into a Statistical Branch with permanent footing in 1945 accompanied by appropriate expansion in its strength. The designation of Statistician was changed to Statistical Advisor. The Statistical Branch soon acquired international recognition as a centre for research and training in the field of Agricultural Statistics. During 1952 on the recommendations of two FAO experts Dr Frank Yates and Dr DJ Finney who visited the Council on the invitation of the Government of India, activities of the Statistical Branch were further expanded and diversified. In 1949 it was named as Statistical Wing of the ICAR and in August, 1955, it moved to its present campus. Subsequently, in recognition of its important role as a training and research institution, the Statistical Wing was re-designated as the Institute of Agricultural Research Statistics (IARS) on 2nd of July 1959. It is to commemorate this important event that the Annual Day of the Institute is celebrated on this day every year. An important landmark in the development of the Institute was the installation of an IBM 1620 Model-II Electronic Computer in 1964. Another major landmark for the Institute was the signing of a Memorandum of Understanding with Indian Agricultural Research Institute (IARI), New Delhi in 1964, consequent to which new courses leading to MSc and PhD degrees in Agricultural Statistics were started in collaboration with IARI in October, 1964. In April, 1970, the Institute was declared as a full-fledged

Institute in the ICAR system and is since then headed by a Director. Since 1st January, 1978 the name of the Institute was changed to Indian Agricultural Statistics Research Institute (IASRI) emphasizing the role of 'Agricultural Statistics' as a full fledged discipline by itself.

Since the activities of the Institute expanded manifold, a new three-storeyed Computer Centre building was constructed in the campus of the Institute in 1976. A third generation computer Burroughs-B 4700 system was installed in March, 1977. A large number of computer programmes for specific problems as also general purpose application software have been developed and are available in the Computer Centre. The old Burroughs B-4700 system was replaced by a Super Mini COSMOS-486 Computer System with more than hundred PC/AT's, PC/XT's and dumb terminals. Computer laboratories equipped with PC/AT's dumb terminals and printers, etc. have been set up in each of the six divisions as well as in Administrative Wing of the Institute. Efforts are on to link these laboratories with the Central Computer Laboratory in a Local Area Network (LAN) environment. User friendly software packages like SPSS, Image Processing Software, Harvard Graphics, LOTUS, d BASE IV, DOS, UNIX and a few others have also been made available. Two projects have been recently initiated, one for developing data-bases in the field of bio-technology as applicable to animal sciences re-

search, and the other for developing computer communication Network linking all ICAR Institutes and SAUs.

In order to remove and rectify deficiencies in the existing documentation services dealing with agriculture, the Food and Agriculture Organisation of the United Nations initiated a series of studies in 1971, to establish the Information System for Agricultural Sciences and Technology (AGRIS). After preliminary trials the System started functioning in 1975. As on 1st November, 1977 there were 82 input centres and 77 liaison offices all over the world, which contribute to the System. Our country is the third largest (next to USA and Japan) among the National input centres, from the point of numbers of inputs added to the System every month. The Institute provides selective information services to scientists in the ICAR Institutes and Agricultural Universities on references to documents relating to areas of their specific interest.

From October, 1983 to March, 1992 the Institute also functioned as a Centre of Advanced Studies in Agricultural Statistics and Computer Applications under the aegis of the United Nations Development Programme (UNDP). This programme aimed at developing a Centre of Excellence with adequate infrastructure and facilities to undertake advanced training programmes and to carry out

research in various aspects of agricultural statistics and computer application. Under this programme thirteen distinguished statisticians and computer experts from abroad (19 visits ; 21.5 man months) have visited the Institute for a period of four to eight weeks with a view to interacting with the scientists of the Institute, give seminars/lectures and suggest improvements in the research programmes of the Institute. Seventeen scientists from this Institute (80 man months) have received training abroad in different areas of research extending over periods of 5-6 months each. In addition, a new course leading to MSc degree in Computer Application in Agriculture has been initiated.

The Institute has achieved international recognition for its high quality research and teaching in the field of Agricultural Statistics. A number of research workers from the Institute have served as consultants and advisors in Asian, African and Latin American countries. Also, a number of statisticians and students of the Institute are at present occupying high positions in universities and other academic and research institutions of USA, Canada and other countries.

A new Multi-storeyed Training-cum-Administration Block in the campus of the Institute was occupied in 1992.

Heads of the Institute since Inception

Dr PV Sukhatme	...	Sep 1940—Jul 1951
Dr VG Panse	...	Aug 1951—Mar 1966
Dr GR Seth	...	Apr 1966—Oct 1969
Dr Daroga Singh	...	Nov 1969—May 1971
Dr MN Das	...	Jun 1971—Oct 1973
Dr Daroga Singh	...	Nov 1973—Sep 1981
Dr Prem Narain	...	Oct 1981—Feb 1992
Dr SK Raheja (Acting)	...	Feb 1992—Nov 1992
Dr RK Pandey (Acting)	...	Dec 1992 onwards

Functional Set-up

The Institute has the following six Divisions and three Cells to undertake research, training, consultancy, documentation and dissemination of scientific output.

Divisions :

- Design of Experiments and Analysis of Experimental Data,
- Sample Survey Methodology and Analysis of Survey Data,
- Forecasting Techniques for Crops, Diseases and Pests,
- Bio-statistics and Statistical Genetics,
- Statistical Economics, and
- Computing Science.

Cells

- Co-ordination,

—Training Administration, and

—Monitoring

Management Committee

The Director of the Institute, who is incharge of the overall management of the Institute, is assisted in the discharge of his functions by the Management Committee of the Institute (constituted by the Council) by providing a broad-based platform for decision making process, by periodically examining the progress of the Institute activities and by recommending suitable remedial measures for bottlenecks, if any. The meetings of the Management Committee were held on Sep 24, 1993 and Jan 29, 1994.

Staff Research Council

The Staff Research Council (SRC) is the most important forum in the Institute to plan and monitor research projects and watch their progress on a regular



Management Committee of the Institute in Session



A Scientist of the Institute presenting her Research Project Proposal at the Staff Research Council Meeting

basis. The final review of the Institute research programmes is also undertaken by the SRC. The meetings of SRC are held under the Chairmanship of Director. As per the decision taken earlier, a Peer Group from outside the Institute is associated in the discussion during the process of formulation of new project proposals.

The meetings of the Staff Research Council were held on May 28 and 31 to discuss the new project proposals and to review the progress of on-going research projects. Dr MN Das, former Director of the Institute and Dr AK Nigam, UGC Professor of Statistics, Lucknow University were invited as outside experts for comments and suggestions on the new project proposals. In all five new projects proposals were presented in the meeting and approved. The progress of all the on-going research projects was also reviewed.

Another meeting of the Staff Research Council was held on January 6, 1994 to consider the new project proposals. Prof MG Sardana, former Director General, CSO, New Delhi was invited as an outside expert for comments and

suggestions on the new project proposals. In all 7 research project proposals were discussed out of which 6 proposals were approved.

The progress of all the on-going research projects in different divisions of the Institute were reviewed in a meeting of Staff Research Council held on Jan 10, 1994.

Annual Day

The Annual Day of the Institute was celebrated on July 2. As a part of these celebrations a Declamation Contest for the students was held. The topic of the contest was 'Statistics for Rural Development'. Dr PN Tiwari, Project Director, Nuclear Research Laboratory, IARI as Chief Guest distributed prizes to the three best speakers in the form of books.

Research Collaboration

Inter-institutional research programme is undertaken by the Institute in collaboration with other institutions.

The collaborative projects which were in operation during 1993-94 are as follows :

Sl. No.	Title	Collaborating Agency	Start	Completion
1	2	3	4	5
1.	Planning, designing and statistical analysis of experiments planned under All India Coordinated Agronomic Research Project at cropping	Directorate of Cropping Systems Research, Modipuram, Meerut	Apr, 1986	Continuing

1	2	3	4	5
	systems research centres and on cultivators' fields.			
2.	Planning, designing and statistical analysis of data relating to experiments conducted under the All India Coordinated Research Project on Long Term Fertilizer Experiments	(i) Deptt. of Soils, ICAR Institutes (ii) Deptt. of Soils, ICAR State Agril. Universities	Jul, 1985	Continuing
3.	Pilot studies on pre-harvest forecasting of yield of stick lac	Indian Lac Research Institute, Ranchi	Oct, 1987	Jun, 1993
4.	Fertilizer response function environment for agro-climatic regions in India	International Food Policy Research Institute, Washington, D.C., U.S.A.	Oct, 1988	Sept, 1993
5.	Use of remote sensing techniques in crop yield estimation surveys	Division of Agricultural Chemistry and Soil Science, IIRS, Dehradun	Apr, 1990	Dec, 1994
6.	Estimation of cost of production of sheep and wool	CSWRI, Avikanagar	Apr, 1991	Mar, 1994
7.	Survey methodology to study economics of keeping goats	CIRG, Makhdoom	Apr, 1991	Sep, 1994
8.	Integrated yield forecast model using biometrical characters, agricultural inputs, weather and remotely sensed data	Division of Agricultural Physics, IARI, New Delhi	Nov, 1992	Oct, 1996

Projects of Emeritus Scientists

Two Emeritus Scientists of ICAR are engaged on the following research projects in the Institute :

Sl. No.	Project Title	Name of Emeritus Scientist	Date of start
1.	Statistical techniques for mid-course bifurcation of experimental plots, plot yield estimation and statistical models for predicting soil nutrient status under long-term fertilizer experiments.	Sh PN Soni	Sep 1, 1992
2.	Statistical inference and computer packages on multiway crossing in plant breeding research.	Dr AS Arya	Sep 28, 1993

Finance

Budget statement for the financial year 1993-94

Head	Non-Plan		Plan	
	Funds (Rs. in Lakhs)	Expenditure (Rs.)	Funds (Rs. in Lakhs)	Expenditure (Rs.)
Pay and Allowances	325.80	3,19,56,733	—	—
OTA	.31	—	—	—
Travelling Allowances	2.80	2,88,679	.50	50,634
Other Charges*	80.09	—	69.50	39,479
i) Maintenance	—	60,30,870	—	—
ii) Other Expenditure	—	5,35,760	—	—
iii) Contingency	—	22,51,902	—	—
iv) Works	6.00	2,03,716	18.00	—
v) Other items (Fellowships)	5.00	5,89,242	—	—

* Includes items (i) to (iii).

Assets

(a) Equipments, Plants	—	41,872	—	18,27,592
(b) Library books and journals	—	2,486	—	12,16,081
(c) Vehicles	—	—	—	1,38,383
(d) Furniture	—	8,884	—	2,01,289
(e) Typewriters, Calculators	—	—	—	55,660
(f) Coolers, Heaters, AC	—	—	—	76,987
Grand Total	420.00	4,19,10,144	88.00	36,06,105
Amount Surrendered	Rs. 51,40,000.00			

Abstract (1993-94)

	Funds (Rs.)	Expenditure (Rs.)	Surrendered (Rs.)
Non-Plan	4,20,00,000.00	4,19,10,144.00	
Plan	88,00,000.00	36,06,105.00	
			51,40,000.00
Total	5,08,00,000.00	4,55,16,249.00	51,40,000.00

In addition to Budget 1993-94

	Funds (Rs.)	Expenditure (Rs.)	Surrendered (Rs.)
N.A.R.P. (for three years)	49,60,000.00	8,49,932.00	40,00,000.00
Summer Institute	90,000.00	61,904.00	
Emeritus Scientist		71,998.00	

PROGRESS OF PROJECTS

DIVISION OF DESIGN OF EXPERIMENTS AND ANALYSIS OF EXPERIMENTAL DATA

Mandate :

To develop statistical designs and methodologies for analysis of data relating to field and laboratory experimentation in agriculture and animal sciences.

Thrust Areas :

- Cropping system research
- Information system for agricultural and animal experiments
- Yardsticks of additional production
- Experimental designs for agricultural, animal and fisheries research

Projects in operation thrust-area-wise

No.	Project title	Project leader and associates
1	2	3

Cropping System Research

- | | | |
|----|---|---|
| 1. | Planning, designing and analysis of experiments on cultivators fields under All India Coordinated Agronomic Research Project (AICARP) | KC Bhatnagar
Mahesh Kumar
NK Sharma |
| 2. | Planning, designing and analysis of experiments planned at stations under Directorate of Cropping System Research | Rajinder Kaur
Ajit Kaur |
| 3. | Planning, designing and statistical analysis of data relating to experiments conducted under AICARP on Long Term Fertilizer Experiments | MR Vats
PR Sreenath
DK Mehta
DK Sehgal |

1	2	3
4.	Methodological investigations in predicting fertilizer response using soil test values and other site variables	Aloke Lahiri DK Mehta NK Sharma
5.	A study of behaviour of crop response to long term fertilizer application with reference to weather parameters	Asha Saksena Ajit Kaur
Information System for Agricultural and Animal Experiments		
6.	Agricultural field experiments information system	RK Ghai DC Pant OP Khanduri
7.	Agricultural experiments information system for animal sciences	GC Chawla PR Sreenath
Yardsticks of Additional Production		
8.	Yardsticks of additional production of oilseeds and pulses from the combined application of fertilisers	CH Rao KC Bhatnagar GL Khurana
Experimental Designs for Agricultural, Animal and Fisheries Research		
9.	Methodological studies relating to agroforestry	BL Choudhary JK Kapoor PR Sreenath
10.	Some statistical studies relating to the design and analysis of experiments involving fixed quantity of inputs	PK Batra Rajendra Prasad OP Khanduri
11.	Studies on optimality of block designs for making test treatment control comparison	R Srivastava VK Gupta Rajendra Prasad
12.	A-optimality of block designs for comparing two disjoint sets of treatments.	Seema Jaggi VK Gupta
13.	Cataloguing and construction of variance balanced block designs : computer algorithms for construction	Rajendra Prasad VK Gupta OP Khanduri

1. Planning, designing and analysis of experiments on cultivators fields under All India Co-ordinated Agro-nomic Research Project (AICARP)

The data of about 5500 experiments conducted during 1991-92 in 25 NARP zones and 13 districts of different states were received and analysed. The results obtained were published in the Annual Report of 1991-92 of Project Directorate of Cropping System Research (ICAR) Modipuram with Scientists associated from the Institute as co-authors.

In addition, data of about 6000 experiments conducted during 1992-93 in 40 O.F.R. centres (NARP zones of different states in the country) were received, scrutinized coded and analysed. The sampling design for the selection of experimental sites and the design for laying out of the experiments was three stage stratified sampling and randomised block. Emphasis was on experiments relating to identification and development of production technology with regard to crop intensification, intercropping and integrated nutrient supply systems.

The salient results obtained from the experiments conducted during 1992-93 are as follows :

To find out need-based cropping systems and to intensify cropping, studies were carried out with 4 to 6 double or multiple cropping systems on cultivators fields. The results revealed that most

promising crop sequences providing very high returns were rice-gobhisarson-greengram or rice-wheat-maize (F) in the central plains of Punjab, cotton-groundnut in central Maharashtra plateau (Rs. 3670/ha). Other profitable sequences netting returns of the order of Rs. 24,000 to Rs. 26,500/ha were rice-wheat in central plains of Punjab, rice-lentil-greengram or rice-gram-maize (F) in north eastern plains of U.P., sorghum-wheat-cluster-bean and sorghum-sunflower-groundnut in central Maharashtra plateau and rice-potato-greengram in north west alluvial plains of Bihar.

Studies to develop suitable integrated nutrient supply systems in rice-wheat cropping system indicate that it is possible to substitute 50 per cent N in the recommended fertilizer dose (100 per cent NPK) with F.Y.M. during kharif in eastern zone of Haryana, Kymore plateau and Satpura hills of M.P., eastern plains, north eastern plain and mid western plains of U.P. with green manure in central and undulating plains of Punjab without any significant decline in yield obtained with the application of 100 per cent NPK. In maize-wheat cropping system, substitution of 25 per cent N with F.Y.M. in the recommended dose (100 per cent NPK) was possible in sub montane hill zone of H.P. and western plain zone of U.P. In rice-groundnut system 50 per cent N could be substituted either by F.Y.M. or sesbania (G.M.) in eastern dry zone of Karnataka.

In intercropping experiments the

results show that intercropping of groundnut with redgram in south eastern plateau of Bihar or soyabean with redgram in north hill zone of Chattisgarh with 100 per cent recommended dose to intercrop provided about 200 per cent additional returns than obtained by sowing the sole main crop under farmers practice. Greengram intercropped with cotton in southern transition zone of Karnataka, mustard with wheat or jowar with redgram at eastern plain zone of U.P., mustard with wheat in sub-montane hill zone of H.P. and blackgram with groundnut in western zone of Tamil Nadu brought additional returns ranging from 80 to 116 per cent as against sowing of sole main crop under farmers' practice.

Studies to evaluate the performance of crop varieties at farmers' level and recommended level of fertilization under irrigated and rainfed conditions showed that the increase in yield with the recommended level was significantly higher under irrigated conditions than under rainfed conditions. In kharif rice the increase in yield ranged from 3.2 q/ha in southern transition zone of Karnataka to 25 q/ha in north eastern plains of U.P. whereas in wheat it ranged from 2.7 q/ha in north Saurashtra zone of Gujarat to 28.6 q/ha in eastern plains of U.P. In groundnut the increase ranged from 1.8 q/ha in southern zone of A.P. to 8.2 q/ha in north dry zone of Karnataka.

2. Planning, designing and analysis of experiments planned at stations under Directorate of Cropping System Research

During the year 23 types of experiments were planned with the objectives of (i) development of new cropping system, (ii) nutrient management in cropping systems, (iii) development of system based management practices, (iv) system based maximum yield research. The data for about 350 complex experiments conducted during 1992-93 at 40 cropping system research centres were subjected to critical analysis.

Experiments on identification of need based cropping system showed that bajra-potato-bajra sequence was found most promising followed by castor bajra at S.K. Nagar (Gujarat). Experiments on long term studies on the relative efficiency of legume-cereal or cereal-legume rotation over cereal-cereal rotations revealed that at Junagadh bajra yielded more when legume crop (gram) was included in the sequence during rabi season instead of taking wheat crop during rabi. It was seen from the experiments on system based maximum yield research that increase in plant population did not bring corresponding increase in grain yield both in maize as well as wheat while application of 150 per cent of the recommended level of NPK resulted in significant increase in the grain yield in both the seasons at Palampur.

3. Planning, designing and statistical analysis of data relating to experiments conducted under All India Coordinated Agronomic Research Project on Long Term Fertilizer Experiments

During this period the data received from various centres in respect of yield, plant nutrient up take and available soil nutrients were scrutinized and analysed. The statistical results were provided to the concerned scientist incharge of the cooperating centres and the Project Coordinator, Long Term Fertilizer Experiments (LTFE).

Regression analysis of the treatment wise cumulative yields of individual crops were carried out to study the yield trends over years. Also the built up or deterioration of soil nutrients over years as a result of intensive and multiple cropping were studied using the regression technique. The statistical results for the years 1989-90 and 1990-91 were tabulated in the form of final tables to be included in the annual report of the project.

4. Methodological investigations in predicting fertilizer response using soil test values and other site variables

The objectives of the study are (i) to identify a suitable statistical model based on soil test values for estimating the optimal fertilizer response, and (ii) to evaluate the economic gain in adopting fertilizer recommendation involving soil test values versus general recommendations.

The data of experiments on cultivator's field conducted by AICARP in respect of 13 centres from different agro-climatic zones have been subjected to stepwise multiple regression. For each centre, the regression co-efficients thus obtained, called site parameters were treated as dependent variables and were regressed over all site soil test values namely, O.C., pH, available N, P_2O_5 and K_2O . This regression equation would replace the site parameters in the original regression equation. Results were obtained over all the years for each district. From this equation, the yield response, profit and fertilizer requirement can be directly calculated by incorporating the soil test values of that site. The economic gain over the general recommended dose can also be calculated. Further work was in progress.

5. A study of behaviour of crop response to long term fertilizer application with reference to weather parameters

The objectives of the project are (i) to study the behaviour of crop response to fertilizer treatments with reference to weather, and (ii) to examine the association between the responses of different crops of successive seasons.

The project was recently initiated.

6. Agricultural field experiments information system

The objectives of the project are to maintain at a central place the results

and other ancillary information in respect of all the Agricultural Field Experiments except purely varietal trials conducted at different research stations spread all over the country. This would avoid duplication of research and assist the scientists in developing efficient research programmes. The data under the project is collected by personal visits of the regional staff posted at different regional centres under senior officers of Agriculture Department/Universities.

The system is based on development of data bank which would store on floppies for future retrieval experimental data in respect of field experiments conducted during 1978 and onwards at different research stations in the country. Necessary software of data storage and its retrieval has been developed. For the period 1978 onwards the regional staff reported during the year, experimental data in respect of about 2200 experiments on Index card/coding schedules prescribed for A.F.E.I.S. While about 350 experiments were reported on the prescribed proformae. Inclusive of these about 23,410 experiments on the coding schedules have so far been reported for the system. Processing and validation of data and their storage was in progress.

7. Agricultural experiments information system for animal sciences

The index of animal experiments pertaining to the period 1966-1980 was developed and its report writing was in progress. The format of about 150

experiments pertaining to various disciplines were completed and data of about 20 experiments have been coded for transferring to floppies.

8. Yardsticks of additional production of oil seeds and pulses from the combined application of fertilizer

The project aims (i) to develop a unified methodology for construction of yardsticks of additional production for combined application of several inputs, and (ii) to work out the yardsticks of additional production of oil seeds and pulses from the use of fertilizer using the above methodology.

Transcription of experimental data was completed. Methodology for estimation of yardsticks for the application of two inputs was worked out and was being generalised for several inputs.

9. Methodological studies relating to agroforestry

The objectives of the study are (i) to develop studies proforma/schedule for data collection on agroforestry experiments, (ii) to analyse the different on going experiments on agroforestry through various available statistical technique and to develop suitable model, and (iii) to suggest and develop suitable design and their statistical analysis.

The ICAR has initiated an All India Coordinated Research Project on Agroforestry for meeting the demand for food, fodder, fuel etc. which has now

been spread to 34 centres apart from National Research Centres. In order to have proper collection of data, designing, analysis and interpretation of outcomes of the system, IASRI has been associated with All India Co-ordinated Research Project on Agroforestry.

To analyse and evolve suitable statistical methodology of the system, data from different research centres are being collected on the experiments on various objectives of agroforestry. The results of analysis of two experiments were obtained and further work in the project was in progress.

10. Some statistical studies relating to the design and analysis of experiments involving fixed quantity of inputs

The objectives of the project are (i) to develop suitable model for describing the response to the fixed quantity of inputs (like fertiliser, pesticides etc.) applied in splits at different crop growth stages, and (ii) to develop/suggest efficient designs for experiments involving split application of fixed dose of inputs.

A large number of experiments for assessing the response of fixed quantity of input when applied in split doses during various stages of crop growth have been conducted at different Agricultural Research stations in the country and are reported to the IASRI under Agricultural Field Experiments Information System (AFEIS). The aim of project is to give

the alternate strategy for the design and analysis of such type of experiments. The methodology to be adopted is to treat these experiments as sort of mixture experiments and modelling of response to input (especially fertilizer) will help in drawing better conclusions from experiments. The data of 100 experiments have been extracted from records of AFEIS and review of Analysis of mixture experiments was in progress.

11. Studies on optimality of block designs for making test treatment-control comparison

The objectives of the project are (i) to critically review the available literature on optimality aspects of block designs for making test treatment-control comparisons, (ii) to obtain optimal block designs for test treatment-control comparisons under two classified, fixed effects and additive homoscedastic with unequal block sizes, (iii) to obtain optimal block designs for test treatments-control comparisons under two way classified fixed effects and additive heteroscedastic model with unequal block sizes, and (iv) to prepare a catalogue of designs obtained under (i), (ii) and (iii).

The work of review of literature was completed. Information matrix under heteroscedastic model have been obtained and attempts were made for minimizing the permutation invariant form of variance-covariance matrix. Some work was also initiated for the combinatorial aspects of these designs.

12. A-optimality of block designs for comparing two disjoint sets of treatments

There are experimental situations when the treatments are of two types the test treatments and the control treatments. In such situation test treatment-control treatment comparisons are made. Here two disjoint sets, each set consisting of two or more than two treatments are considered.

The objectives of the project are (i) to obtain proper balanced block designs for making comparison among treatments belonging to two disjoint sets, (ii) to obtain balanced block designs with unequal block sizes for comparing two disjoint sets of treatments, (iii) to study the A-optimality of the designs constructed and to investigate the efficiency of these designs, and (iv) to prepare a catalogue of such designs.

To study the A-optimality of the

block designs, the expressions for the trace of the variance-covariance matrix of the contrasts of interest was derived and the work on minimization of this trace was in progress.

13. Cataloguing and construction of variance balanced block designs : computer algorithms for construction

The broad objectives of the study are (i) to review the available literature on the methods of construction of variance balanced (binary and non-binary) block designs, (ii) to prepare a catalogue of available variance balanced block designs and their efficiency factor, (iii) to make an attempt to fill the gaps by giving some new methods of construction, and (iv) to give computer algorithms/programs to generate variance balanced block designs.

The project was recently initiated and the work of review of literature was in progress.

**DIVISION OF SAMPLE SURVEY METHODOLOGY AND ANALYSIS
OF SURVEY DATA**

Mandate :

To evolve sample survey techniques for estimation of various parameters of interest relating to crops, livestock, fishery, forestry and allied fields and to develop techniques for analysis of survey data.

Thrust Areas :

- Cost of production studies
- Statistical modelling for production and growth
- Energy utilization
- Inland fish catch estimation
- Studies involving repeated measurements
- Production and area estimation
- Assessment and evaluation studies
- Remote sensing technology applications
- Non-sampling errors estimation
- Small area estimation
- Estimation of post production losses
- Methodological studies in complex surveys

Projects in operation thrust-area wise :

No.	Project title	Project leader and associates
1	2	3

Cost of Production Studies

1. Estimation of cost of production of sheep and wool	TB Jain PS Rawat (CSWRI) Riyazuddin SC Sharma	, , , ,
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1	2	3
2. Survey methodology to study economics of keeping goats		RL Rustagi SC Agarwal Shivtar Singh
3. Pilot sample survey to study the economics of Angora rabbits		KPS Nirman Shivtar Singh Bhagwan Dass
4. A study of variability of different components of cost of production of fruits at different stages of sampling and estimation of sample sizes at given levels of precision		MS Batra OP Kathuria
5. Pilot sample survey to develop a sampling methodology for estimation of poultry meat production		MS Kaushik TB Jain
Statistical Modelling for Production and Growth		
6. Statistical modelling for projection of bovine populations and prediction of milk availability		SN Arya SC Agrawal HP Singh
Energy Utilization		
7. Pilot sample survey for estimating the energy utilization for different levels of adoption of modern technology in agriculture		KK Tyagi PC Mehrotra Satya Pal
Inland Fish Catch Estimation		
8. Sampling methodology for estimation of fish catch from a lake		HVL Bathla OP Kathuria KK Kher
Studies Involving Repeated Measurements		
9. Pilot sample survey for estimation of yield of pepper and study of cultivation practices using successive sampling		SS Shastri VK Jain PM Ramesan
Production and Area Estimation		
10. Study for estimation of area and production of important vegetable crops on the basis of partial harvest		AK Srivastava DL Ahuja DC Mathur K Chug

1	2	3
11.	Development of estimation procedures for agricultural by-products	NK Ohri PC Mehrotra RC Gola
12.	Pilot sample survey for evolving a sampling methodology for estimation of area and yield of cultivated fodder crops other than berseem and jowar crop, cost of production and cultivation practices thereof	Anand Prakash BC Saxena KK Tyagi
13.	Pilot sample survey for estimating the area under wasteland	SS Gupta PC Mehrotra
14.	Sample survey for estimation of cashewnut and cashew apple yield and study of its cultivation practices	SS Shastri VK Jain PM Ramesan
Assessment and Evaluation Studies		
15.	Sample survey for study of constraints in transfer of new agricultural technology under field conditions	PC Mehrotra SS Gupta NK Ohri GS Bassi RC Gola SS Shastri MS Narang
16.	A sampling study on utilization of crossbred working animals vis-a-vis non-descripts	JP Goel RS Khatri
17.	Investigations in sampling methods for multiple frames in two stage sampling	BC Saxena AK Srivastava
18.	Sample Survey to evolve suitable sampling methodology to study impact of command area irrigation project on agricultural production	AS Gupta PC Mehrotra RM Sood
Remote Sensing Technology Application		
19.	Use of remote sensing techniques in crop yield estimation surveys	Randhir Singh RC Goel BM Singh (IIRS) SK Shah (IIRS)

1	2	3
Non-Sampling Errors Estimation		
20.	Investigation on the use of imputation for missing data in sample surveys	Randhir Singh T Rai
Small Area Estimation		
21.	Small area estimation of milk Production	Shivtar Singh DK Bhatia
22.	Estimation of crop yield for small areas	AK Srivastava DC Mathur DL Ahuja SC Sethi
Estimation of Post Production Losses		
23.	Pilot sample survey for developing a sampling methodology for estimation of post production losses of milk in rural areas	RS Khatri JP Goel
24.	A methodological investigation in estimating seasonal fluctuation of post-harvest foodgrains losses (wheat)	Jagbir Singh HC Gupta OP Kathuria
Methodological studies in complex surveys		
25.	Chi-square tests in survey data	Anil Rai AK Srivastava HC Gupta

1. Estimation of cost of production of sheep and wool

This project was formulated by this Institute in collaboration with Central Sheep and Wool Research Institute, Avikanagar (Rajasthan) with the objectives to develop a suitable methodology for studying economics of sheep rearing in relation to wool production under stationary type of management, and to secure estimates of different components of cost of rearing of sheep and production of wool.

The survey was initiated in Malpura and Tonk tehsils of Tonk district in Rajasthan. A two-stage random sampling design with villages having sheep as the psu's and households rearing sheep in a selected village as the ssu's was adopted in the project. Out of villages having sheep, 16 villages from Malpura tehsil and 24 from Tonk tehsil were selected with probability proportional to sheep population in the village with replacement. For detailed enquiry, 6 sheep rearers were selected from each village.

In the first instance, a preliminary enumeration of all the sheep rearers was carried out in the selected villages. Under detailed enquiry the relevant data on various components of cost of maintenance of sheep and production of wool were collected from selected sheep rearers at a regular interval of one month. The field survey work was completed.

The statistical analysis of data collected under detailed enquiry survey was completed and the draft report on the project was prepared.

2. Survey methodology to study economics of keeping goats

The project aims (i) to develop sampling methodology for estimation of cost of rearing and maintenance of goats and income accrued from various sources connected with goat keeping with a reasonable degree of precision, (ii) to study the practice of goat keeping and to develop procedures for evaluation of cost components, and (iii) to study variation in cost and its components due to season and size of flock.

The field survey was conducted in Mathura district. Stratified three stage sample design was adopted for selection of samples having 18 panchayats as psu's, 54 villages as ssu's and 324 goat keeping households as tsu's.

Under detailed enquiry survey, the data on various items of keeping goats were collected at fortnightly intervals for one year. The analysis of data was in progress.

3. Pilot sample survey to study the economics of Angora rabbits

The project was initiated with the objectives (i) to obtain reliable estimates of cost of rearing and maintenance of rabbits, and (ii) to estimate cost of production of rabbit wool with reasonable degree of precision.

The field survey work was completed. Data collected under preliminary enumeration were analysed and analysis of data collected under detailed enquiry was in progress.

4. A study of variability of different components of cost of production of fruits at different stages of sampling and estimation of sample sizes at given levels of precision

The objectives of the study are (i) to study variability at different stages of sampling of the components of cost of production of some important fruit crops, and (ii) to estimate sample sizes for given levels of precision using the above variabilities.

This study is based on secondary data drawn from some pilot studies conducted by IASRI in the recent past to estimate cost of production of some important fruit crops in Gujarat state on the basis of fixed sample sizes.

The data already collected by the method of cost accounting was utilized to determine variability at different stages of sampling for different components of cost and their aggregates according to

the different concepts of cost so as to suggest different sample sizes for given levels of precision for the conduct of similar surveys in future. The project report was under finalisation.

5. Pilot sample survey to develop a sampling methodology for estimation of poultry meat production

The project was recently initiated with the objective to develop a suitable sampling technique for estimating the total poultry meat production in Gurgaon district of Haryana state.

In the first instance the preliminary enumeration work of all the commercial poultry farms in the district was completed and the spade work for conducting the detailed inquiry survey was in progress.

6. Statistical modelling for projection of bovine populations and prediction of milk availability

This project aims (i) to identify/develop suitable models for projection of bovine population in various categories on the basis of empirical studies, (ii) to conduct a comparative study of different models so as to recommend appropriate models for use in varying situations, and (iii) to arrive at a suitable method for prediction of milk availability in future.

Statistical analysis of data pertaining to bovine population as well as to the milk production was in progress. Different techniques for projecting the

category-wise population of bovines were being applied so as to identify the appropriate models.

7. Pilot sample survey for estimating the energy utilisation for different levels of adoption of modern technology in agriculture

The main objective of the project was to develop suitable sampling methodology for estimating the energy utilization for different levels of adoption of modern technology in terms of labour and inputs like irrigation, fertilisers, etc.

The analysis work was completed and the project report remained under finalisation.

8. Sampling methodology for estimation of fish catch from a lake

The study was initiated with the objectives (i) to review the data collection procedures and the present method of reporting catch from lake/reservoir in the state of Orissa, (ii) to develop a suitable methodology for estimation of fish catch, and (iii) to see the feasibility of estimating fish catch by using partial data.

The statistical analysis of data pertaining to estimation of fish catch as per the sampling design adopted was carried out. The methodology for estimation of fish catch using part of the data was being worked out.

9 Pilot sample survey for estimation of yield of pepper and study of cultivation practices using successive sampling

The objectives of this project are (i) to develop suitable sampling technique for estimation of yield and study of cultivation practices of pepper, (ii) to estimate the changes in yield estimation, and (iii) to study the relative efficiency of yield estimates generated through different patterns of successive sampling.

Field work in the project remained in progress. Analysis of data collected from Maharashtra, Karnataka and Tamil Nadu was in progress.

10 Study for estimation of area and production of important vegetable crops on the basis of partial harvest

The objectives of the study are (i) to develop a suitable theoretical framework for sampling from two dimensional populations spread over space and time with particular reference to vegetable crops, (ii) to apply and test the theory on secondary data collected under earlier vegetable surveys at IASRI in order to develop a suitable methodology for estimating the production of vegetable crops based on partial harvests, and (iii) to estimate the total production of important vegetable crops and their yield rates on the basis of partial harvest.

The project was proposed to be attempted in two phases. In the first

phase the theory for two dimensional sampling in the context of surveys on vegetable crops was to be developed and tested on the basis of secondary data already collected by the Institute in Delhi and Pune. The first phase study has nearly been completed and the work of the drafting of its report was in progress. Based on the analysis of first phase study, the planning work for the second phase study on primary data collection was started.

11. Development of estimation procedures for agricultural by-products

The study aims (i) to develop appropriate procedures for estimation of production of important agricultural by-products, (ii) to develop estimation procedure for straw to grain ratio for a region for maximising the precision of the estimate and to study the extent to which it is affected by different agronomic and management practices, and (iii) to work out the optimum fraction of crop cutting experiments on which the straw yield should be recorded for estimating straw to grain ratio.

The secondary data on grain yield and straw as available from the project "sample survey for study of constraints in transfer of new agricultural technology under field conditions" was tabulated and analysed with the help of scatter diagrams and fitting of regressions. As some of the observations were suspected as stray, the technique

of detection of outliers was applied to the data before subjecting to the above analysis.

Further work in the project was in progress.

12. Pilot sample survey for evolving a sampling methodology for estimation of area and yield of cultivated fodder crops other than berseem and jowar, cost of production and cultivation practices thereof

The survey was conducted in Ghaziabad district with the objectives of the project (i) to evolve a sampling methodology for estimation of area and yield of fodder crops other than jowar and berseem, and (ii) to estimate the consumption of different feeds fed to the animals and their maintenance practices.

The design adopted in the project was one of stratified random sampling with tehsils as the strata villages as the p.s.us, fields as the s.s.us and a plot of specified size as the ultimate unit of sampling.

The statistical analysis work in the project was in progress.

13. Pilot sample survey for estimating the area under wasteland

The survey on wasteland was taken up in Udaipur district of Rajasthan with the objectives to estimate the area under wasteland, to find out the causes of

wasteland and also to find out its alternative uses and the extent to which it can be reclaimed.

The field work was completed and the data received were being scrutinised and coded as per the card designs and coding instructions prepared. Further work was in progress.

14. Sample survey for estimation of cashewnut and cashew apple yield and study of its cultivation practices

The project was recently initiated to study the extent of cultivation, yield and cultivation practices of cashew. The yield will include estimation of bearing and non-bearing young trees, cashew apples and nuts.

Field survey work in all the seven talukas of Goa district was in progress.

15. Sample survey for study of constraints in transfer of new agricultural technology under field conditions

Sampling investigations were undertaken for evolving suitable sampling methodology for studying the effect of new agricultural technology for higher productivity of land and to identify and investigate factors that inhibit its transfer under field conditions in 16 selected districts spread over 9 states of the country.

The objectives of the project are (i) to develop suitable sampling methodology for studying the effect of new

agricultural technology including high yielding/improved varieties/fertilisers, plant protection chemicals and cultural and management practices for increasing productivity of land, (ii) to determine the extent to which the potential of high yielding/improved varieties has been achieved under field conditions, and (iii) to identify and investigate constraints and limiting factors in the transfer of new agricultural technology to cultivators' fields.

Drafting of the report for 1985-86 was completed. Analysis of data for later years was in progress. The work of drafting of the report for the 1986-87 was in progress.

16. A sampling study on utilisation of crossbred working animals vis-a-vis non-descripts

This study aims (i) to compare the utilisation pattern of the two types of working animals, (ii) to estimate the extent of utilisation of working animals, and (iii) to study the factors influencing varying levels of utilisation of working animals.

The work of analysis of data and drafting of the project report was in progress.

17. Investigations in sampling methods for multiple frames in two stage sampling.

The objectives of the study are (i) to investigate the estimation of population

parameters like mean, total, ratio etc. in multiple frame situation for multi-stage sampling, and (ii) to examine simultaneous estimation of various characters in multiple frame surveys.

The report on the project was under finalisation.

18. Sample survey to evolve suitable sampling methodology to study impact of command area irrigation project on agricultural production

The objectives of the study are (i) to develop sampling methodology for determining yield rates of crop in command and non-command areas of irrigation project with a reasonable precision, and (ii) to study the impact of command area on cropped area, cropping pattern, cropping intensity, agronomic and management practices and other development measures.

The project was in operation in command area of lower Bhawani canal, District Periyar (Tamil Nadu) and its adjoining area as non-command area from 1987-88 to 1990-91.

The survey covered Lower Bhavani Canal Command Area Project in district Periyar of Tamil Nadu state. The crops studied were paddy and groundnut. It was seen that for paddy crop, the sample size of 96 crop cuts adopted was adequate for estimating the average yield for estimating the average yield for different reaches of canal/for different holding size classes as also for major varieties, the

standard error of the estimates being of a lower order of less than 10 per cent. The index of the effect of command area (the excess yield in the command area over the non-command area) expressed as percentage of the average yield of non-command area was highly variable over the reaches of canal as well as over time being in the range of 3 and 77. Also in non-command area, the average yield over reaches of canal were of a much significantly low order than those in command area. Fertilizer use was of a much low order as compared to the recommended levels. Both the average yield and fertilizer use did not show any association with the size of holding. However, a significant difference in varietal preference was observed. In case of groundnut crop, the data were generally scanty for drawing any valid conclusions.

19. Use of remote sensing techniques in crop yield estimation surveys

The project was taken up to investigate the usefulness of satellite gathered spectral data in crop yield estimation surveys for stratification according to crop vigour and growth conditions for wheat crop in Sultanpur district of Uttar Pradesh. The relative efficiency of estimator of crop yield from crop yield estimation survey using post-stratification based on False Colour Composites (FCC) were also examined. The use of spectral data alongwith the survey data resulted in great improvements in the efficiency of the yield estimation.

20. Investigation on the use of imputations for missing data in sample surveys

Simulation technique was used to study relative performance of different imputation procedures. It was seen that imputation through regression performs better than other procedures in case of random missing data. The report on the findings of the study was under finalisation.

21. Small area estimation of milk production

This project was taken up with a view to provide district-wise estimates of milk production by adopting the small area estimation techniques. The procedure usually consists in utilising the auxiliary information for getting improved estimates. In this study the information on crossbred and non-descript animals was used for developing synthetic, direct and composite estimators. The usefulness of groupings on the basis of breeds was tested. The gain due to synthetic method of estimation when cell values are known appears to be substantial. However, when the cell values are estimated the gain is only marginal. The investigation revealed that the composite estimator may be preferred to synthetic and direct estimation when sample size is small and cell values are estimated.

22. Estimation of crop yield for small areas

The study was initiated to estimate

the crop yields at small area (Block/ Tehsil) level for principal crops utilising small area estimation techniques.

The approach of synthetic method of estimation based on estimated auxiliary information for cell values was further investigated. The method was applied to real field data for crop yield estimation of two principal crops wheat and paddy in Haryana state. The work of report writing was in progress.

23. Pilot sample survey for developing a sampling methodology for estimation of post production losses of milk in rural areas

The objectives of the project are (i) to evolve a sampling technique for estimation of post production losses, and (ii) to estimate the percentage of post production losses at different stages. The data were collected from a representative sample using stratified two stage random sampling design with tehsils as strata, village as psu and household as ssu. A total sample of 20 psus was allocated to different strata in proportion to the number of village in them. In every selected psu, the households were classified as 'producers' and 'purchasers' and 5 households from each village were selected every day from both the classifications for detailed enquiry. In addition to this all the cycle vendors and confectioners located in the selected psu were observed. The data were collected by careful enquiry and

the reference period was the day prior to the day of visit of the enumerator.

Analysis of data was in progress.

24. A methodological investigation in estimating seasonal fluctuations of post-harvest foodgrains losses (wheat)

The study is based on secondary data utilised from another project undertaken earlier by the Institute on 'Pilot sample survey for the estimation of post-harvest foodgrains losses.'

The study aims (i) to estimate the post-harvest foodgrains losses due to various operational causal factors, (ii) to estimate the seasonable fluctuations in post-harvest foodgrains losses due to various operations and causal factors, (iii) to investigate the design effect of the used sampling design, and (iv) to determine the optimum sample size. The sampling design of the present study was of a partial replacement pattern of the sampling units. Under this study the zone-wise elementary estimates along with their variances based on matched and unmatched sampled data on post-harvest foodgrains losses due to germs, weevils and all the causes of damage in various modes of storage for all the three years (1985 to 1987) were worked out. All the correlation matrices separately for holding size-wise as well as overall holdings wise, matched and unmatched sampled data on cultivator-wise and percentage losses occurring due to afore-

said causes of damage at storage at farm levels, were worked out for all the four quarters of three consecutive years. After preparing the macro-programmes, final estimates for yearly/quarterly percentage losses and fluctuations therein and for average percentage losses for the years 1985-87 due to various operational and casual factors at the stages of harvest, threshing and storage at farm level for the district Bullandshahr were obtained. The draft report on the project was prepared.

25. Chi-square tests in survey data

The study was recently initiated with

the objectives (i) to find out the effect of sampling design on ordinary chi-square tests for survey data, (ii) to evaluate the performance of various modified chi-square statistics for survey data, and (iii) to suggest suitable modification for chi-square statistics in sparse contingency table.

A multivariate normal population was simulated on the basis of census data of Muktsar, Punjab and stratification of the population was done by using Delenius and Hodges (1959) method.

DIVISION OF BIO-STATISTICS AND STATISTICAL GENETICS

Mandate :

To conduct applied and basic research in the field of statistical genetics and bio-statistics.

Thrust Areas :

— Statistical modelling in animal and plant breeding.

Projects in operation thrust-area wise :

No.	Project Title	Project leader and associates
Statistical Modelling in Animal and Plant Breeding		
1.	Modelling curvilinear response among crossbred dairy cows with increasing level of exotic inheritance	VT Prabhakaran BS Sharma
2.	Statistical modelling for comparing genetic groups of crossbred goats for growth studies based on multiple traits	Lal Chand SD Wahi VK Bhatia
3.	Application of Bootstrap techniques for studying the statistical properties of genetic parameters	SD Wahi VK Bhatia Lal Chand
4.	Studies on spatial patterns and its role in analysis of agricultural field experiments	VK Bhatia Prem Narain (IARI) JS Samra (CSWCTRI)

1. Modelling curvilinear response among crossbred dairy cows with increasing level of exotic inheritance

The project aims to formulate various hypotheses explaining curvilinear response and to test these hypotheses through empirical data.

The statistical analysis of data remained in progress.

2. Statistical modelling for comparing genetic groups of crossbred goats for growth studies based on multiple traits

The objectives of the project are (i) to develop growth performance index by combining several body measurement traits, (ii) to cluster various genetic groups into homogeneous clusters by different clustering procedures and to develop some suitable criterion to compare the efficiency of these procedures, (iii) to study the combining ability for individual growth traits and for growth performance index, and (iv) to estimate the genetic parameters such as heritability, phenotypic and genetic correlation etc. for component traits as well as for the index.

Breeding data of goats pertaining to the period 1975-85 were adjusted for non-genetic effects (fixed) such as season, period, number of kids born, etc. by least square techniques. The adjusted records were utilised to develop linear discriminant function so as to maximize the variation 'Between genetic groups'

relative to 'Within genetic groups' for the composite character 'y' based on body weight, pin-shoulder length, growth velocity and growth rate upto one month of age of the animals.

Genetic parameters such as heritability, genetic correlation etc. for the component traits as well as for the growth performance index based on body weight, P.S. Length, growth velocity and growth rate were worked out for each genetic group.

Work regarding clustering of various heterogeneous groups into homogeneous groups for comparing the performance of goats on the basis of multiple traits was in progress.

3. Application of bootstrap techniques for studying the statistical properties of genetic parameters

The project aims (i) to examine different procedures for assessing the accuracy of genetic parameters viz. heritability and genetic correlation, (ii) to study the sampling distribution of estimates of genetic parameters, and (iii) to obtain the optimum number of bootstrap replications for getting the satisfactory estimates of sampling variance and confidence intervals.

The data on crossbred goats were utilised for the purpose. In order to assess the reliability of the heritability (h^2), confidence interval were obtained by standard procedure as well as by percentile method. In some of the

situations it is also observed that standard intervals are biased. The confidence interval were modified by accounting the effect of its bias. Which was done both on real as well as simulated data. These methods were also compared by normalized lengths. The number of bootstrap replications required for standard errors and confidence interval were also obtained.

Further work was in progress.

4. Studies on spatial patterns and its

role in analysis of agricultural field experiments

The objectives of the project are (i) to examine the spatial variability present in soil characteristic and its influence on plant growth traits, and (ii) to examine suitable statistical models for treatment comparison in the presence of spatial dependence among observations.

The analysis of data broadly contained both the components of variography and kriging. The project was under finalisation.

**DIVISION OF FORECASTING TECHNIQUES FOR CROPS,
DISEASES AND PESTS**

Mandate :

To develop statistical models for obtaining pre-harvest forecast of crop production on the basis of biometrical characters, weather parameters and agricultural inputs and also to develop forecast models for incidence and intensity of pests and diseases.

Thrust Areas :

—Crop yield forecast models

Projects in operation thrust-area wise :

No.	Project Title	Project leader and associates
Crop Yield Forecast Models		
1.	Integrated yield forecast model using biometrical characters, agricultural inputs, weather and remotely sensed data	Ranjana Agrawal RC Jain
2.	Pilot studies on pre-harvest forecasting of yield of stick lac	SK Saha (ILRI) AK Jaiswal (ILRI) BH Singh
3.	Composite forecast of sugarcane yield	SC Mehta Chandrasah
4.	Yield forecast based on weather variables and agricultural inputs on agro-climatic zone basis	Ranjana Agrawal RC Jain SC Mehta
5.	Statistical modelling for forecasting of marine fish catch	SS Walia Balbir Singh
6.	A statistical model for assessing the effect of weeds on crop yield	GN Bahuguna Madan Mohan

1. Integrated yield forecast model using biometrical characters, agricultural inputs, weather and remotely sensed data

Various objective methods are used to forecast crop yields which utilise data on (i) plant characters, (ii) weather variables and inputs, (iii) agro-meteorological variables, and (iv) spectral parameters. Generally one of these different types of data are being used to develop the forecast model. The models so developed are not very satisfactory in many cases. Attempts are being made to develop integrated model using two or more types of data so as to improve forecasting capability of the model.

This is a collaborative project between Division of Agricultural Physics, IARI, New Delhi and IASRI to develop an integrated model for wheat yield forecast.

Second round of field experiment was planned and laid out accordingly.

Fortnightly observations were collected on the characters pertaining to :

- (i) *Plant characters* : number of plants per metre row length, plant height, length and breadth of flag leaf, leaf area index, dry matter, grain yield at harvest,
- (ii) *Agromet parameters* : soil moisture and canopy temperature, and

- (iii) *Spectral data* : Crop reflectance corresponding to 4 bands used in satellite data.

First year data were screened and transferred on floppies for analysis.

2. Pilot studies on pre-harvest forecasting of yield of stick-lac

This project was formulated by the Indian Lac Research Institute in collaboration with this Institute with the objective to develop suitable model for obtaining pre-harvest estimates of yield of stick-lac on the basis of yield affecting characters such as crown of lac hosts, number of inoculable shoots, length of inoculable shoot/tree, weight of bread lac, settlement of trees and number of pests.

The data collected from Palamau district of Bihar were analysed year-wise and pooled over from 1987-88 to 1989-90.

The results indicated that the forecast of stick lac under Baisakhi and katki seasons is possible at 10-30 days stage of crop growth. The value of R^2 was of the order of 40 to 59 percent due to various contributing factors.

3. Composite forecast of sugarcane yield

The objectives of the project are (i) to explore the feasibility of improvement in the models already developed for obtaining pre-harvest forecast

of crop yield on the basis of biometrical characters, (ii) to develop appropriate models for forecasting crop yield on the basis of weather parameters, and (iii) to develop suitable statistical methodology for improving forecast of crop yield by combining the forecasts from two approaches based on weather parameters and biometrical characters.

During the period under report the attempts were continued to further improve the models based on biometrical characters using some dummy variables. It was found that the contribution of these variables were negligible and hence no more improvement could be made.

Regarding development of models based on weather parameters such as temperature, relative humidity, wind speed, rainfall, number of rainy days and cloud amount etc., various models to study single effects and joint effects were studied by using monthly data for the period 1951-80. On the basis of these results, the forecast models based on the data for the period 1951-77, 1951-78 and 1951-79 were developed. The forecast yield computed from these models for the years 1978 to 1980 deviated from the observed ones by 3.9 to 9 per cent.

Further analysis work was in progress.

4. Yield forecast based on weather variables and agricultural inputs on agro-climatic zone basis.

Crop yield forecast models using

weather variables were developed on district level. Generally such studies require long series of data on different weather variables and crop yield which are not available for most of the districts. The data of various districts within an agro-climatic zone may be pooled so that a long series could be obtained in a relatively short period. It will also enable us to obtain forecast of crop yield on a wider area. With this view, studies have been taken up to forecast rice and wheat yield using weather variable and agricultural inputs on agro-climatic zone basis.

Various forecast models were developed for rice and wheat crops in rainfed agro-climatic zone of Madhya Pradesh. Models were developed using :

- (i) pooled weather and yield data for various districts in the zone,
- (ii) taking previous years yield as indicator of place and trend effect,
- (iii) using dummy variables for district, and
- (iv) taking deviations from district, means.

Out of the various models, model using data (iv) was found to be best but this also was not very satisfactory. This may be due to lot of missings in the data. Attempts were being made to deal with this problem.

5. Statistical modelling for forecasting of marine fish catch.

The study was taken up with the primary objective to develop appropriate models for forecasting of marine fish catch and to test the adequacy of models developed so as to recommend most appropriate model for each state under study. There are twelve maritime states/union territories in India. The fish catch data was not available for two Union Territories, namely, Andaman and Nikobar and Lakshdweep.

Quarter-wise actual marine fish landings data for 40 points of time pertaining to ten maritime states/Union Territories, namely, Orissa, Kerala, Tamil Nadu, Pondicherry and Karaikal, Karnataka, Goa, Andhra Pradesh, Maharashtra, Gujarat and West Bengal were collected from special publications of Central Marine Fisheries Research Institute, Cochin released on 40th Anniversary of the Institute under the heading 'An appraisal of marine fisheries for the ten states/Union Territories' mentioned above. The data were compiled in the form of time-series for different states and different points of time were denoted as period 1 to 40. Twelve models which were developed for each state under study were

- Simple moving average,
- Double moving average,
- Fundamental exponential smoothing,
- Double exponential smoothing,
- Triple exponential smoothing,
- Winter's model,
- Brownian exponential smoothing,

- Holts linear exponential smoothing,
- (Trend analysis) linear model,
- Quadratic model,
- Exponential model, and
- S-curve model

Mean square errors for each of the above mentioned models were obtained for each state. Thereafter the adequacy of each model was tested by comparing the mean square errors of all the models developed for a particular state. The model having the least mean square error for a particular state was chosen as the most appropriate model for that state.

In Orissa, the most appropriate model chosen was *Winter's Model* which is most suitable for the data which has seasonal variations, with optimum values of smoothing constants chosen as $\alpha=\beta=\gamma=0.05$. The percent standard error of the model obtained was 7.07. In Kerala, most appropriate model chosen was *Winter's Model* with optimum values of smoothing constant as $\alpha=\beta=\gamma=0.10$ and percent standard error of 4.37. In Tamil Nadu the most appropriate model found was *Quadratic model*; $56613.3 - 494.538 T + 18.3309 T^2$ with percent standard error of 4.99. In Pondicherry and Karaikal *Winter's model* with $\alpha=\beta=\gamma=0.20$ and percent standard error was 4.34. In Karnataka, *Quadratic model* $16879.9 + 1287.6 T - 23.0239 T^2$ was found to be most appropriate model with per cent standard errors as 15.22.

In the remaining five states, namely,

Goa, Andhra Pradesh, Maharashtra, Gujarat and West Bengal 'Winter's model' was found to be most appropriate with percent standard errors as 7.69, 5.09, 6.37, 8.64, and 14.79 respectively.

It can be concluded that in two states, namely Tamil Nadu and Karnataka only, the most appropriate model chosen was Quadratic model while in the remaining eight states 'Winter's model' was chosen as the most appropriate model. Moreover in Tamil Nadu and Karnataka the second best model found was Winter's model. So in general, it can be concluded that the marine fish catch data has the seasonal variations and Winter's model was most suitable for the data.

6. A statistical model for assessing the effect of weeds on crop yield.

The study is carried out on wheat crop for two rabi crop seasons viz., 1984-85 and 1985-86 with the objective to develop statistical model for estimating loss in crop yield due to weeds. Such a study is considered important since quantitative determination of losses after harvest would be useful in setting priorities for both weed control research and for commercial weed control operations in future years. The data utilised for this study were weed population counts of important non-graminaceous weeds, dry matter weight of weeds and yield of wheat crop.

Regression models of crop yield are then fitted on weed characters using step-wise regression technique. Also indices of each weed character recorded at different periods are constructed using the correlation coefficient of crop yield with weed characters as weights and these indices are used as regressors in the model. Crop loss is estimated on the basis of these fitted models. Avoidable loss in crop yield through the adoption of suitable weedicidal treatments is also obtained on the basis of difference between treated plot yield and control plot yield.

The results of the analysis of data revealed that appropriate crop loss estimates can be obtained by using dry matter weight of weeds recorded at 60 days after sowing as regressor variable. During 1984-85 and 1985-86 this model explained 63 per cent and 57 per cent variation in crop yield with crop loss estimates as 23.73 per cent (S.E. 3.90) and 15.13 per cent (S.E. 1.90) respectively.

The avoidable loss is estimated as 1031 kg/ha with a standard error of 3.53 per cent and 474 kg/ha with a standard error of 8.65 per cent for 1984-85 and 1985-86 respectively. This loss on percentage basis is estimated as 22.15 and 9.42 of possible average yield through adoption of suitable weedicidal treatments for 1984-85 and 1985-86 respectively.

DIVISION OF STATISTICAL ECONOMICS

Mandate :

To develop appropriate stochastic models and methods for quantification of economic phenomena related to agriculture.

Thrust Areas :

- Technological change and its diffusion in agriculture
- Resource use efficiency in agriculture
- Farm planning under risk and uncertainty
- Demand and supply of various agricultural products and inputs

Projects in operation thrust-area wise :

No.	Project title	Project leader and associates
1	2	3

Technological Change and its Diffusion in Agriculture

- | | |
|--|--|
| 1. Non-linear statistical models for adoption of HYVs in India | VK Sharma
Prajneshu
Sushila Kaul |
| 2. Implications of technological change on input use and output mix in crop production | RK Pandey
Shanti Sarup |
| 3. Estimation of economic gains from technological advance in rice production | Ashok Kumar
RK Pandey |

Resource Use Efficiency in Agriculture

- | | |
|--|------------|
| 4. Testing relative economic efficiency and determination of factor demand and output supply functions for wheat | SS Kutaula |
|--|------------|

Farm Planning under Risk and Uncertainty

- | | |
|--|---------------------------|
| 5. Study of farmers' behaviour towards risk and its impact on cropping pattern, level of resource use and farm income. | SP Bhardwaj
VK Mahajan |
|--|---------------------------|

Demand and Supply of Various Agricultural Products and Inputs

- | | |
|---|------------------------------------|
| 6. Estimation of demand for agricultural credit and its effect on farm income and employment. | UN Dixit
Ashok Kumar
Ant Ram |
|---|------------------------------------|
-

1. Non-linear statistical models for adoption of HYVs in India.

The objectives of the project are (i) to develop non-linear statistical models for adoption of High Yielding Varieties (HYVs) of various foodgrain crops at state level. Modification of the existing statistical theory for auto-correlated errors will also be undertaken, wherever necessary, (ii) to attempt various theoretical generalization of the adoption models, and (iii) to develop multi-equation statistical models for explaining the spatial differences in the values of the parameters of the adoption process.

Attempts were made to develop non-linear statistical models that describe the path of adoption of HYVs of rice in different states. The rice growing states considered were: Punjab, Orissa, Haryana, Maharashtra, Bihar, Karnataka, Tamil Nadu, Assam, Madhya Pradesh, Uttar Pradesh, Gujarat, Rajasthan, Himachal Pradesh, West Bengal, Andhra Pradesh, Jammu and Kashmir and Kerala.

Three non-linear models viz. the monomolecular, logistic and the Gompertz were found to explain more than 85 per cent of the variation present in the area under HYVs of rice relative to the total area under the crop. Levenberg-Marquardt algorithm was used for fitting the models and the area under HYVs relative to the total area under the crop (Y_t) during the year t was taken as the dependent variable. It was observed that the initial value of the proportion of area under the HYVs of rice was determined to a significant extent by the percentage target set for this variable in the states while the ceiling value was influenced largely by the percentage of irrigated area under the crop. Similar results were obtained in the case of total cereals. The report on the project was under finalisation.

2. Implications of technological change on input use and output mix in crop production

The objectives of the project are (i) to examine the suitability of different

models for studying technological change in crop production, (ii) to examine the effects of technological change on factor share and to study the effects of technological change on input use and output mix of crops, and (iii) to study the effects of technological change on output mix and input use in the production of crops.

The study pertains to the examination of technological change in main cereal crops in the state of Uttar Pradesh which has been undertaken for different zones. Data pertaining to resource use and productivity for different crops are obtained from the Directorate of Economics and Statistics, New Delhi. The production functions for different periods depicting technical change were being estimated for examining the resource productivity and factors share in the production of rice and wheat. The analysis of data was in progress.

3. Estimation of economic gains from technological advance in rice production

The project aims (i) to develop an appropriate model for estimating the economic gains from technological advance in rice production, (ii) to examine the historical change in the yield of rice crop across different states due to technological advance, and (iii) to estimate the economic gains across different rice growing states due to new technology in rice production.

The project is based on secondary data. An attempt has been made to

develop an empirical frame work for estimating the economic gains from technological advance in rice production. The behavioural change in the yields of rice crop during different periods have been examined by using spline function for some of the rice growing states.

Further analysis of data in the light of development model was in progress.

4. Testing relative economic efficiency and determination of factor demand and output supply functions for wheat

The objectives of the project are (i) to test the relative economic efficiency between large and small farms of wheat crops, (ii) to determine the demand for labour and fertilizer in the production, and (iii) to determine the output supply function.

The farm level wheat data of Punjab and Haryana states for the year 1985-86 collected from Directorate of Economics and Statistics, New Delhi were utilised in this study.

Applying Lau-Yotopoulos test to 1985 Punjab and Haryana wheat data, it was inferred that there was no significant difference in relative economic efficiency between large and small wheat farms. Further unconstrained and constrained joint generalised least squares under the methodology of seemingly unrelated regression estimates have been analytically applied for the determination of factor demand and output supply functions to wheat data of both states after appropriate software development.

5. Study of farmers' behaviour towards risk and its impact on cropping pattern, level of resource use and farm income

The project was initiated (i) to study farmers' behaviour towards risk with respect to purchased inputs, (ii) to identify the determinants of attitude towards risk for sampled farmers, and (iii) to examine the impact of risk on cropping pattern, level of resource use and farm income.

The analysis of farm level data collected on various aspects of risks, input use and farming conditions from

farmers of Ghaziabad and Alwar districts was in progress.

6. Estimation of demand for agricultural credit and its effect on farm income and employment

The project aims (i) to estimate the demand for credit on different size of holdings under various farm situations taking into account the risk factor, (ii) to evaluate the effect of credit on income and employment, and (iii) to simulate the models for policy analysis.

The work of collection of secondary data and analysis was in progress.

DIVISION OF COMPUTING SCIENCE

Mandate :

- To develop computer software based on modern statistical methods for the analysis of agricultural and animal sciences research data
- To undertake teaching of computer applications in agriculture research
- To conduct ad-hoc training courses on use of computers in agricultural research
- To provide scientific support in research data analysis to research workers in agricultural and animal sciences

Thrust Areas :

- Development of software for agricultural research data analysis and data base management system
- System modelling and simulation

Project in operation

No	Project Title	Project Leader
Development of Software for Agricultural Research		
1.	Development of software for mixed models	IC Sethi

1. Development of software for mixed models

Reviewing the relevant literature the BLUP procedure was adopted for the project. The algorithm of softwares was outlined and the flow-chart for the software was developed, standardized and the models were identified. Further work in the project remained in progress.

Software Development

- Five new programs and modification of a number of existing programs to meet the requirements of users.
- Software for “Development of A Decision support system for Orange growers of Maharashtra”

- Software for “Computer—Aided Diagnosis system for important insect pests diseases and physiological disorders of Mango crop”.
- Software for “Predicting of Rhizobium viability”.
- Software for “Predicting the pesticides concentration at different soil depths”.
- Software for “Development of a computerised information system for monitoring research project files”.

Teaching Activities

The Division organised the following training courses for the benefit of scientists and technical staff of ICAR Institutes and Agricultural Universities.

- (i) I training course on “Use of computers in agricultural research” for NARP scientists from Aug 16-28, 1993. Thirteen participants attended the course.
- (ii) XX short term course on “Use of computers in agricultural research” for ICAR, IASRI and IARI scientists and technical officers from Sept 1-15, 1993. Twentyseven participants attended the course.
- (iii) XXI short term course on “Use of computers in agricultural research” for scientists of other ICAR Institutes from Sept 16-30, 1993. Twentyone participants attended the course.

- (iv) A certificate course in Statistical Computing from April 7-Sept 24, 1993. The scientists of the Division took the classes on use of computers in statistical computing.
- (v) II training course on “Use of computers in agricultural research” for NARP scientists from Jan 22-25, 1994. Nineteen participants attended the course.
- (vi) A refresher course in Agricultural Statistics and Statistical Computing from Jan 3-Mar 25, 1994. The scientists and technical staff took 30 lectures and 10 practical classes on statistical computing.
- (vii) A training course on “UNIX operating system SPSS and ORACLE” for scientists and technical officers of IASRI from Feb 28-Mar 15, 1994 for the scientists and technical staff of IASRI. Fifteen participants attended the course.
- (viii) XXI short term course on “Use of computers in agricultural research” for scientists and technical staff of ICAR, IARI and IASRI from Mar 16-31, 1994. Twenty three participants attended the course.

Scientific Support in Research Data Analysis

—No. of Ph.D. scholars	: 21
—No. of M.Sc. scholars	: 22
—No. of other research workers	: 7

Computer Utilization

Details of computer utilisation are as under :

(A) P.C. System

—No. of P.C. users : 9,930
—No. of hours of PC use : 17,111

For all the regular and ad-hoc training programs for computer application, conducted by IASRI, P.C.s were used for practical classes and demonstration purposes.

(B) Data Entry Unit

—No. of batches created for recording : 413

—No. of data records created on floppies : 2.05 lacs

—No. of records transferred from floppies to PCs : 4,930

—No. of records printed : 11,638

—Total records corrected on floppies : 13,095

—Total records corrected on PCs : 82,039

—No. of records created on line : 5,023

PRIMARY DATA COLLECTION

Projects for which primary data were collected either through Institute's own field staff or through ad-hoc staff of the collaborating agencies are as follows :

- Planning, designing and analysis of experiments on cultivators' fields under All India Coordinated Agronomic Research Project (AICARP).
- Planning, designing and statistical analysis of data relating to experiments conducted under AICARP on Long Term Fertilizer Experiments (LTFE).
- Methodological studies relating to agroforestry.
- Planning, designing and analysis of experiments at stations under Directorate of Cropping System Research planned under PDCSR.
- Pilot sample survey for estimating the area under wasteland—Udaipur (Rajasthan).
- Pilot sample survey for estimation of yield of pepper and study of cultivation practices using successive sampling-Sindhudurg (Maharashtra), Kodagu (Karnataka) and Gudalur and Coimbatore (Tamil Nadu).
- Sample survey for estimation of cashew nut and cashew apple yield and study of its cultivation practices (Goa).
- Pilot sample survey to develop a sampling methodology for estimation of poultry meat production, Gurgaon (Haryana).
- Estimation of demand for agricultural credit and its effect on farm income and employment, Muzaffarnagar (Uttar Pradesh).
- Pilot sample survey to study the economics of Angora rabbits, Kullu (Himachal Pradesh).

POST-GRADUATE TRAINING AND EXTENSION

The four regular post-graduate training courses ; Professional Statisticians Certificate Course, Diploma in Agricultural and Animal Husbandry Statistics Course, Senior Certificate Course and Course in Advanced Computer Programming which were being conducted at the Institute (the first two courses since 1945) were discontinued in 1985 and a new set of short refresher courses namely Refresher Course for Statisticians and Agricultural Scientists and a short term course on the Use of Computer in Agricultural Research have been started from 1986 and are being conducted on a regular basis. To meet the growing demands from various agencies for training to their staff a new certificate course in Statistical Computing has been introduced from 1993. Apart from this, the Institute continued to conduct, in collaboration with IARI, two degree courses leading to M.Sc. and Ph.D. degrees in Agricultural Statistics and M.Sc. degree course in Computer Application in Agriculture. During 1993-94, 12 students were admitted to various courses : 6 Ph.D., 3 M.Sc. in (Ag. Stat.) and 3 M.Sc. (Computer Application). Sixteen students : 6 Ph.D. and 5 M.Sc. in Agricultural Statistics and 5 M.Sc. in Computer Application

successfully completed their degree programmes.

Training Courses

Refresher Course in Statistics for Agricultural Scientists

The Refresher Course in Statistics was organised for the benefit of agricultural scientists and other personnel working in ICAR Institutes and Agricultural Universities.

The main objective of the refresher course was to impart basic knowledge of statistical techniques to persons who may not have formal training in statistics but who use the scientific statistical techniques in their research and other day to day activities. The Course covered :

- Statistical Methods,
- Data Processing and Computer Programming,
- Design of Experiments,
- Survey Sampling,
- Statistical Genetics, and
- Econometric Theory

The Sixth Refresher Course in Statistics for agricultural scientists was

organised at the Institute from Jan 3 to Mar 25, 1994. The orientation programme of the course was held on Jan 3 which was attended by 6 participants. The Valedictory Function was held on Mar 25 in which Dr RK Pandey, Director was the Chief Guest.

Advanced Course on 'Models in Survey Sampling'

One week advanced course on 'Models in Survey Sampling' was organised at the Institute during Dec 20-24, 1993. Dr RK Pandey, Director of the Institute inaugurated the course. Thirteen participants i.e. 2 from Directorate of Agriculture, Bangalore; one each from North Eastern Hills University, Shilong; GBPUAT, Pantnagar, CIFRI, Barrackpore and 6 from IASRI attended the training course. The course coverage comprised of (i) Role of models in efficiency comparisons of sampling strategies, (ii) Use of linear regression models in estimation, (iii) Searching for optional sampling designs, (iv) Models in small area estimation and (v) Models in the study of non-sampling error. The Valedictory Function of the training course was organised on Dec 24, 1993 and Dr RK Pandey, Director, IASRI distributed the certificates to the participants.

Short-term Courses on 'Use of Computer in Agricultural Research'

The XX and XXI short term training courses on 'Use of Computer in

Agricultural Research' were organised during Sep 1-15, 1993 and Sep 16-29, 1993 respectively. The XX course was for scientific/technical personnel from ICAR Institutions located in Delhi. This was attended by 27 scientists/technical personnel from IARI and IASRI. The XXI course was for participants from ICAR Institutes (outside Delhi) and State Agricultural Universities. This was attended by 21 participants.

A Valedictory Function jointly for the two courses was held on Sep 29, 1993. Dr RK Pandey, Director of the Institute gave the Welcome Address. Dr A Ahmad, DDG (Education), ICAR delivered the Valedictory Address and distributed certificates to 56 participants. Sh Mahesh Kumar, Prof (CAA) and Course Coordinator presented the report on the training courses. Shri SN Mathur, Principal Scientist and Head of the Division of Computing Science gave the Vote of Thanks.

The XXII short term training course on 'Use of Computer in Agricultural Research' was organised during Mar 16-31, 1994. The course was for scientific/technical personnel from ICAR Institutions located at Delhi. This was attended by 24 scientists/technical personnel.

The main emphasis in the training was given on practical aspects of using micro computers, features of MS-DOS, Editors, solving of simple problems using BASIC language and use of

MICROSTAT, PC CARP and dBASE III plus application packages. Adequate practice on work on PCs was provided to the trainees.

The Certificate Course in Statistical Computing

The first certificate course in Statistical Computing was organised at the Institute during Apr 7-Sep 24, 1993. The course was inaugurated by Dr RK Pandey, Director, IASRI on Apr 7, 1993. It was attended by 9 participants from ICAR Institutes and State Government Departments. As a part of the training program, a study tour was organised for the trainees from Jun 3—5 to Dr YS Parmar, University of Agriculture, Solan (HP), Central Potato Research Institute, Shimla and National Dairy Research Institute, Karnal.

A Valedictory Function to distribute the certificates was held on Sep 24, 1993. Dr PN Bhat, Deputy Director General (Animal Sciences), ICAR was the Chief Guest.

NARP Training Programs

First training course on 'Use of computer in agricultural research' for National Agricultural Research Projects (NARP) scientists was organised from Aug 16-28, 1993. Thirteen participants 2 from CCSHAU, Hissar, 1 from BCKV, West Bengal, 5 from RAU, Jodhpur, 3 from PAU, Ludhiana and 2 from HPKV, Palampur attended the course. The course was inaugurated by Dr SP Ghosh, Project Director, NARP.

The course coverage comprised of lectures and practical training on operating system MSDOS, data base management system dBASE IV, spreadsheet package LOTUS 1-2-3, graphics package HARVARD GRAPHICS, text processing package WORDSTAR 6.0, and statistical packages MICROSTAT and SPAR 1. Some special lectures on computer networking, recent trends in information technology and virus and vaccine were arranged at NIC, Lodhi Road, New Delhi. Dr RK Pandey, Director, IASRI distributed the certificates to the participants at the Valedictory function.

Second training course on 'Use of computer in agricultural research' for NARP scientists was organised from Jan 12-25, 1994 at IASRI. The course was inaugurated by Dr AP Saxena, ADG, NARP. Nineteen participants 1 from CCSHAU, Hissar, 2 from CSAU, Kanpur, 2 from GB PUAT, Pantnagar, 2 from IGKV, Raigarh, 4 from JNKVV, Jabalpur, 3 from PAU, Ludhiana and 5 from SKUAST, J & K attended the course. The course comprised of lectures and practical classes on the operating system MSDOS, the spread sheet package LOTUS 1-2-3, the data base management system REFLEX 2.0, the text processing package WORDSTAR 6.0, the graphics package HARVARD GRAPHICS, the statistical package MSTAT-C and SPAR 1. Some special lectures on Computer NETWORKING, recent trends in Information Technology at NIC, Lodhi Road, New Delhi were organised,

Prof. Prem Narain, Dean, Post Graduate School, IARI and former Director, IASRI distributed the certificates to the participants at the Valedictory Function.

Summer Institute

The Summer Institute on 'Advances in Agricultural Statistics' was organised at the Indian Agricultural Statistics Research Institute from May 17 to Jun 5, 1993, with the approval of the Council. Dr PR Sreenath, Principal Scientist and Head, Division of Design of Experiments and Analysis of Experimental Data was the Director of the Summer Institute and he was assisted by Dr VK Gupta, Senior Scientist as the Co-Director. The Summer Institute was inaugurated by Dr RK Pandey, Director, IASRI. The faculty of the Summer Institute, besides the Director and Co-Director, was drawn from IASRI (24 members), IARI (5 members), Delhi University (3 members), ISI (2 members), JNU (1 member), Retired Senior Scientist (1), Lucknow University (1), HAU (1) and Project Directorate on Cattle (1).

In all, 47 applications were received of which 30 were offered admission. A total of 26 participants, three of them from the IASRI, attended the Summer Institute. The participants were drawn from the State Agricultural Universities and ICAR Institutes/Project Directorates located in the states of Assam, Bihar, Himachal Pradesh, Karnataka, Kerala,

Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Uttar Pradesh and Union Territory of Delhi. The participants were at least post graduates in Agricultural Statistics/Statistics or equivalent and were working not below the rank of Assistant Professor or Junior Scientist or equivalent.

The programme for the Summer Institute included lectures on various topics in Agricultural Statistics, two group discussions and an open problem session besides the general discussion, library consultation etc. The topics for the lectures were on Design and Analysis of Experiments, Statistical Genetics, Sample Surveys, Statistical Economics, Statistical Computing, Statistical Forecasting, Modelling and Statistical Methodologies.

The participants were very much satisfied with the course, despite its schedule being very tight, both in its content and the delivery of the lectures. The participants were provided with the lecture notes on the topics.

The Valedictory Function of the Summer Institute was held on Jun 5, 1993. Sh JS Sarma, former Economic and Statistical Adviser to the Govt. of India and Emeritus Scientist (IFPRI) as the Chief Guest at the function distributed the certificates to the participants and delivered the valedictory address. Dr RK Pandey, Director, IASRI delivered the welcome address.

Visits of Foreign Nationals

Mr H. Som, Regional Statistician



Dr A Ahmad, DDG (Education), ICAR giving certificates to the participants of short-term course on Use of Computer in Agricultural Research



Prof Prem Narain, Dean and Joint Director (Education), IARI giving certificates to the participants of II Training Programme for NARP Scientists

from FAO's Regional Office in Bangkok visited the Institute on Apr 2, 1993. The Director and Heads of Divisions acquainted the visitor with the activities of the Institute with particular reference to the situation of agricultural statistics and new developments in this area. Mr Som was also taken round to the Computer Centre of the Institute.

Eight African Nationals, two each from Zambia, Malawi, Uganda and Tanzania accompanied by Dr BD Tripathi, Programme Officer, MANAGE, Hyderabad visited the Institute on Nov 24, 1993 regarding the International Programme "Study visit on Monitoring and Evaluation of Training and Visits System of Extension Research".

Director, IASRI and Head, Monitoring Cell discussed the role of statistics in agricultural research with them.

A Chinese delegation of five members who were in India to exchange ideas in the area of Science and Technology indicators, visited the Institute on Mar 2, 1994. Director and Heads of Divisions acquainted the visitors with the activities of the Institute and a detailed discussion on data base on agriculture scientists, R&D projects in agriculture and other statistical data bases was held. They were taken to the Computer Centre for providing them a glimpse of the role it is playing in the research and development of agriculture in the country.

Training programmes organised for trainees from other organisations

Sl. No.	Name of programme	Dates	No. of trainees	Sponsoring agency	Lecturers
1	2	3	4	5	6
1.	XIX Batch of ISS probationers	Jun 24	15	C.S.O., New Delhi	Dr RK Pandey Dr PR Sreenath Sh SN Mathur Dr PC Mehrotra
2.	Jr. Certificate Course in Statistics	Dec 23	24	C.S.O., New Delhi	Dr OP Kathuria Dr Randhir Singh
3.	M.Sc. (Stat)	Jan 03	45	Andhra University, Waltair	Dr PC Mehrotra Sh HO Agrawal

1	2	3	4	5	6
4.	M.Sc. (Stat)	Mar 07	11	Deptt. of Stat., Punjab University, Chandigarh	Dr Randhir Singh Sh OP Dutta
5.	XX Batch of ISS Probationers	Mar 18	24	C.S.O., New Delhi	Dr RK Pandey Dr PC Mehrotra Sh SN Mathur Dr VK Gupta

Research Fellowships

During 1993-94, 8 M.Sc. and 11 Ph.D. students received research fellowships, M.Sc. students received fellowship at the rate of Rs. 1200/- p.m. each besides Rs. 3000/- per annum as contingent grant. Out of the 11 Ph.D. students 9 received fellowship at the rate of Rs. 1800/- p.m. each in the I and II year and 7 students received fellowship at the rate of Rs. 2100/- p.m. in the III year in addition to Rs. 5000/- per annum as contingent grant.

Hostels

There are two well furnished hostels viz. Panse Hostel and Sukhatme Hostel to cater to the residential requirements of the trainees and students of M.Sc. and Ph.D. courses at the Institute within its premises. Officers and other trainees to the various other refresher, short-term and ad-hoc courses organised at the Institute are also provided residential accommodation at the Panse Hostel. Ample facilities exist for the cultural activities and sports for the hostel

in-mates. Hostel mess is run by the students on cooperative basis. The general management of the hostels is vested in the Warden, who is assisted by Prefect and the other students. The main activities included :

- Annual sports meet of students was organised.
- Annual Day of the Hostel was celebrated.
- Diwali, Christmas, New Year Day and Holi were celebrated.
- Students of IASRI receiving M.Sc. and Ph. D, degrees were felicitated jointly by the Director and the faculty of the Institute.
- Cricket match between staff and student was held on Mar 12, 1994 in which acting Director was the captain of the staff side.

Seminars

The result of the research projects and field trials undertaken in



Dr VK Gupta, Senior Scientist and Co-Director, Summer Institute on Advances in Agricultural Statistics presenting the course report at the Valedictory Function



Chinese Delegation visiting the Computer Centre of the Institute

different aspects of Agricultural Statistics and Computer Applications were presented in the seminars organised regularly in the Institute. During the

period under report 77 talks were delivered by the scientists, research scholars and various experts, the ones delivered by eminent scientists are :

Sl. No.	Speaker	Topics
1.	Prof Simo Puntanen, University of Tainpiere, Finland	Some matrix results related to regression diagnostics
2.	Dr D Das, Purkayastha Public Service Commission, N.W. Washington D.C., 20001, USA	Methodological issues of a comprehensive evaluation plan for agricultural research program
3.	Dr BD Tikkiwal, Ex-Senior Prof of Statistics, University of Rajasthan	Micro-level planning and new challenges to statisticians
4.	Prof KR Shah, University of Waterloo, Canada	(i) Analysis of nearly orthogonal classification (ii) Recovery of inter block information

Advisory Service

The Institute continued to play another important role of giving technical advice and guidance in regard to problems in Agricultural Statistics and sampling techniques particularly in the statistical aspects of the projects financed by the ICAR.

Technical advice and guidance were also rendered to research workers and students of the various research Institutes, universities and other research organisations in planning of their experimental investigations and in processing and analysis of data on the computer.

PUBLICATIONS

The major publications of the Institute comprised about 50 papers and popular articles the details of which are as follows :—

Research Papers Published

1. AMRIT PAUL KAUR and BHATIA, VK (1993). Empirical study of different estimators of heritability. *Indian J. Dairy Science*, 56 (7) : 296-301.
2. BHARDWAJ, SP and PANDEY, RK (1992). Growth of Fertilizer Industry in India. *Industrialisation in India, Deep and Deep Publication*, New Delhi : 426-437.
3. BHARDWAJ, SP and PANDEY, RK (1993). Study of production, trade and policy reform for lac cultivation in India. *Bihar Journal of Agricultural, Marketing*, 1 (3) : 404-419.
4. BHARDWAJ, SP and MAHAJAN, VK (1993). Crop production and resource allocation under risk—A case study. *Indian Jour. Agril. Eco.*, 38 : 401.
5. CHAWLA, GC and RAJAGOPALAN, M (1993). Efficient estimates from sequential sampling of non-overlapping clusters. *Annals agric. Res.*, 14 (3) : 342-344.
6. DIXIT, UN and ASHOK KUMAR (1993). Role of risk in pulses production. *Indian Jour, Agril. Eco.* 48 (3).
7. GAUR, HS ; SINGH, JAGWANT and GUPTA, HC (1993). Distribution of the reniform nematode, *rotylechuslus reniformis* in an eggplant solanum melongena field. *Annals of Plant Protection Science*, 1 (2) : 99-104.
8. KUTAULA, SS (1993). Application of frontier technology to wheat crop grown on reclaimed soils. *Indian J. Agril. Eco.*, 48 (2) : 226-236.

9. KUTAULA, SS (1993). Technological innovations in agriculture-Policy options for social welfare. *Economic & Political Weekly*, 8 (29, 30).
10. MAHAJAN, V; KHERA, AS; PAL; SS and GUPTA, AS (1992). Combining ability of plant height and leaves gained per day in maize. *Crop Research Jour*, 5 (2) 391-394.
11. MEHROTRA, PC (1993). A scheme for post-stratification in two-stage sampling. *Jour. Ind. Soc. Agri. Statist.*, 45 (1) : 163-170.
12. PANDEY, RK and ASHOK KUMAR (1993). Economic study of agricultural wages, output and productivity in Orissa *Indian Jour. Agril. Eco.*, 48 (3) : 477-481.
13. PANDEY, RK and SHANTI SARUP (1992). Study of growth and factors affecting rice production in Orissa. *Journal of Agricultural Issues*, 4 (1 & 2).
14. PANDEY, RK and BHAR-DWAJ, SP (1993). Analysis of minor forest produce—A case study of Shellac trade in India, *Ind. Jour. Agri. Eco.*, 38 : 57.
15. PRAJNESHU and SHARMA, VK (1992). A non-linear statistical model for adoption of high yielding varieties. *Ind. J. Appl. Statist.*, 1 : 12-18.
16. RAI, T; BATRA, MS; MOHAN LAL and PATHAK, GM (1993). Economic return through inter-cropping in chikoo orchards. *Annals agric. Res.*, 14 (2) : 159-162.
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- Pilot studies on pre-harvest forecasting of apple yield on the basis of data of biometrical characters, weather factors and crop inputs in Simla district of Himachal Pradesh during 1980-88 (1992) by Chandrahas and Prem Narain.
- Estimation of repeatability of fruit yield in presence of biennial rhythm (1993).
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- Use of spectral data in Markov Chain Model for crop yield modelling.
by Randhir Singh and AI Ibrahim.
- Estimation of crop yield using post-stratification based on satellite data.
by Randhir Singh and RC Goyal

Dissertations Approved

Ph.D. (Agri. Stat.)

1. **PALANICHAMY, KV—Some contributions to designs for fitting non-linear response surfaces.**

The problem of selecting explanatory

variables for the case of non-linear models has been investigated. The design criterion heavily depend on initial guess of the parameters in non-linear set up. The criterion of D-optimality is used for selecting any design. Running the design criterion at different combinations of the values give the beneficial effect of obtaining an interval of parametric values to proceed with. As the experiments proceed further, one can make the interval finer. The models which contained some parameters which are linear, the design criterion does not depend on them. An example is constructed where the design criterion does not depend on the parameters. Robustness of the criterion against poor initial estimates have also been examined.

Replication structure of the experiments under a non-linear set up has been examined. Replicating all the basic design points equally give increased values of the criterion. A sufficient condition for a replicated design to be optimum is provided.

(Guide : Dr RC Jain)

2. **PANDEY, ARCHANA—Study of optimality block designs under a mixed effects model.**

For eliminating heterogeneity in one direction, block designs are useful. Whenever the number of treatments are large, homogeneity within blocks cannot be ensured so one has to resort incomplete block designs. In the usual linear, additive fixed effects model, the

block effects are considered to be fixed. However, when experimental units are fairly heterogeneous then this results in loss of information residing in the block designs. When the block effects are considered random, there is an additional source of information for estimating treatment effect parameters. Such models are known as mixed models. Optimality of block designs under such a mixed model is considered in this work. Firstly, A-optimality of block designs, for making test treatments—control comparisons has been studied under a mixed effect model. The optimality of variance balanced designs for only test treatments—control is studied and a condition for a Balanced Test Treatment Incomplete Block (BTIB) design to be A-optimal in the class of designs $D(v, b, \gamma, \rho)$. Since it is difficult to give a general method of construction of A-optimality design, satisfying this condition, some methods of constructing BTIB designs have been described. A catalogue of BTIB designs constructed by various methods alongwith their A-efficiencies is reported. It has been found that a design which is A-optimal (or high efficient) under a fixed effects model is also A-optimal (or high efficient) under a mixed effects model. Secondly, optimality of block designs for comparing two disjoint sets of treatments under a mixed effects model has been examined. The optimality of variance balanced designs for estimating all the differences between two treatments from two groups is

investigated. Various methods of constructing Balanced Two Disjoints Sets of Treatments Designs (BTDT) are reported and a catalogue of such designs alongwith their A-efficiencies for the designs which are not A-optimal are given. Again, it has been found that designs which are A-optimal (or high efficient) under fixed models are also A-optimal (or high efficient) under mixed models. The optimality of block designs under a mixed model for comparing test treatments with control treatment (s) for proper block designs are studied. E-optimality of proper block designs has been studied under a mixed model and a lower bound for smallest positive eigen value of C matrix of a connected block design under a mixed model is obtained. In particular, E-optimality of extended BIB designs, group divisible designs with $\lambda_2 = \lambda_1 + 1$ and abridged BIB designs is investigated using these bounds. An attempt has also been made to give the procedure of analysis for the recovery of inter-block informations for designs with non-proper and unequal replications.

(Guide : Dr VK Gupta)

3. SHARMA, YOGENDRA KUMAR — Some studies on regression analysis with survey data

Regression analysis is widely used in survey data analysis for deriving a concise description of a body of data, and estimation of regression coefficients including identification of explanatory variables with important effects. In

regression analysis parameters are estimated generally by OLS technique. The basic assumption of OLS is that error terms are independently distributed. But with the survey data this basic assumption is violated except in case of SRS with replacement.

In regression analysis normally two approaches are available i.e. design based and model based. In model based approach the inferences are based on parameters of a probability distribution related to a super population.

In the present study some design based estimators and model based estimators have been compared. Also investigations have been carried out to study the effect of different survey designs on OLS estimators through a simulation study.

(Guide : Dr Randhir Singh)

4. SHUKLA, RK—Some investigations on the effects of genetical-statistical model assumptions on the estimates of genetic parameters.

This dissertation deals with the estimators and corresponding probabilities of inadmissible estimates of heritability from full-sib and half-sib analyses under finite population assumptions in a comprehensive manner.

The expressions for mean squares and estimates heritability from full-sib and half-sib analyses under finite popu-

lation assumptions have been derived. Formulae for working out the maximum number of dams which can be mated with any one sire during a specific reasonable period of time (population size of dam effects= N_d) and the maximum number of full sibs that are expected from a single dam in its productive life time (error population size = N_e) have been derived. To get admissible estimates, expressions have been developed for optimum values of N_d and N_e in the full-sib as well as half-sib case. Also the values of N_d and N_e to be used in the estimation of genetic parameters in bovines and ovines have been tabulated for ready reference. It has to be appreciated that the chance of getting inadmissible estimates of heritability from full-sib and half-sib analysis could be much less under finite population assumptions.

It has been shown that in full-sib analysis the probabilities depend on all the components of genetic variance. For sex-limited as well as general trait when the true heritability is less than or equal to 0.25 the probabilities or sire component as well as sire-dam component taking values greater than unity has been shown to be quite small under all types of gene action. However, in the case of dam component these probabilities get very much inflated if large non-additive genetic variance is present.

Under additive model, for sex-limited trait, larger number of observations are required to minimise the frequency of

inadmissible estimates of heritability of a lowly heritable trait than when it is highly heritable. It has also been noticed that for a given value of h^2 many more observations are required to minimise the frequency of inadmissible estimates from dam component than are required when one uses either sire component than are required when one uses either sire component of sire-dam combination. Further, for sex-limited lowly heritable traits, under finite population assumptions, for obtaining admissible estimate in 95 per cent of the cases, saving of 50 per cent observations from sire component and 70 per cent from dam component or sire-dam combination have been noticed as against 25 per cent and 40 per cent respectively in the case of general trait. When $h^2 \geq 0.25$ the adoption of the finite population model leads to 40 per cent, 60 percent—70 percent and 50 percent—60 percent saving by sire component, dam component and the combined estimate respectively for sex-limited traits and 20 percent, 30-40 percent and 30 percent—35 percent for general traits.

Under non-additive model the probability of inadmissible estimates is shown to be depending upon the type of gene action involved. The general trend of probabilities of inadmissible estimates of heritability of general as well as sex-limited traits is observed to be more or less the same, although the actual figures in terms of the number of observations for minimizing the frequency of

inadmissible estimates, saving in number of observations under finite population model etc. are different. For sex-limited traits, the total probability of inadmissible estimates from sire component decreases with increase in the level of bias whenever $h^2 \leq 0.25$ and at $h^2 = 0.50$ the probability increases as bias increases. The distortions of heritability estimates for sex-limited and general traits are much higher under finite population model as compared to the infinite model.

It is interesting to note that the effect of finite population model on the probabilities from half-sib analysis is very small and the half-sib estimate is not at all comparable with the sire component heritability. For obtaining admissible estimates in 95 percent of the case, the half-sib analysis needs to be based on 470, 240 and 170 observations if the heritabilities are 0.10, 0.25 and 0.50 respectively. Percentage saving in observations for lowly heritable general trait is 30 percent from half-sib analysis which is comparable to sire component heritability for the trait. In other words, heritability of a lowly heritable general trait can be computed by either half-sib analysis or by the sire component. The probability of inadmissible estimates is more when the family size is below the optimum family size (i.e. $d=4/h^2$) than when it is above. It is, therefore, recommended that in the estimation of heritability of a lowly heritable trait, it is desirable that the design has family

size in the range 30-40 progeny per sire and for highly heritable, a family size of around 10 progeny per sire would be ideal.

(Guide : Dr VT Prabhakaran)

5. SINGH, DALIP—Some studies in small area statistics

The need for small area statistics has been growing over the years due to their increasing use for planning purposes at micro level. In order to satisfy this need, small area techniques have been developed which utilise sample survey data from a population to make inferences about the average or total of some quantity in the sub-domains or small areas of that population where the sample size realised in each small area is insufficient for the estimation purpose. The utilisation of auxiliary information is vital for generating good small area statistics. The present study is concerned with the investigation of various aspects related to nature and availability of auxiliary information.

Recent developments in small area estimation indicate the use of various approaches which assume that the relevant auxiliary information is available in appropriate form. However, there are situations where auxiliary information is not available in required form. Two estimators of cell level auxiliary information using Raking Ratio method have been proposed. These estimators are evaluated based on a simulation study. The effect of estimated auxiliary information on the ratio synthetic estimators reveals that Raking Ratio technique can

be a dependable tool for estimation of auxiliary information. Further, based on simulation study, it was observed that knowledge of group marginals for Raking is not a severe restriction and that one can work with estimated group marginals without losing much efficiency.

Another form of estimators which utilise auxiliary information are the regression estimators. These estimators also require auxiliary information at required level, which may not be available. For this situation also, the regression estimators with estimated auxiliary information have been proposed. A simulation study has been conducted to evaluate the performance of the regression estimation with known auxiliary information and with estimated auxiliary information. The effect of model departures on the performances of these estimators has been considered. It is observed that synthetic estimators outperforms all other estimators when model holds whereas in case of mild to severe departures from the model, dampened regression estimator performs better. The use of estimated auxiliary information does not much vitiate the properties of these estimators. However, if the loss of information is more due to estimated auxiliary information which may happen when variability in x is more and number of sample observations are same as for character 'y', then the use of historical data is suggested provided certain assumptions are satisfied.

(Guide : Dr AK Srivastava)

Ph. D. (Agril. Economics)

1. DAVID, ALVARIS—Impact of technology on foodgrain production in sub-montane zone of Maharashtra.

This work was undertaken in the sub-montane Zone of Maharashtra to study the level of application of technology and to develop a technological index for foodgrain production; to examine the input-output relationship and allocative efficiency at different levels of technology adoption ; to study the effect of technological change on functional income distribution and to suggest appropriate direction of technological change in foodgrains production. Both primary and secondary data, relating to the years 1990-91 and 1993-94, respectively, were collected. Besides simple statistical tools, the indexing technique and multiple regression analysis were the analytical techniques used. Nine types indices, one simple, four weighted with cost and four, with the area under the component, were developed for both the time periods. HYVs seed, N.P.K. pesticides and other chemicals, irrigation and machinery were the components of new technology considered for computing the index. In case of all the crops, viz. paddy, jowar and wheat under the present study, (except gram, for which it was lower), the technological adoption level was found to be higher during 1990-91 when compared to 1983-84, but the rate of technology acceptance was very slow. Higher levels of technology resulted in higher productivity in all the

crops. With increased technology levels, the consumption of HYV seeds, irrigation, fertilizers, human labour and machinery, in case of jowar fertilizers, in case of wheat, were found to increase. The analysis of resource use efficiency depicted that only human labour at low level of adoption in paddy was optimally allocated. At different levels of adoption, seed, fertilizer, human labour and bullock labour in case of paddy, fertilizer and human labour in case of jowar, human labour in case of wheat and bullock labour in case of gram, were underutilized, while irrigation and bullock labour at high adoption level in paddy, human labour at high adoption level in case of jowar and gram and bullock labour at low adoption level in case of wheat were overutilized. The functional income distribution analysis depicted that at higher adoption levels, the technological change was biased in favour of land (residual) and capital but against labour in case of paddy and gram; in favour of land (residual), neutral to labour and against capital in case of jowar and in favour of land but against labour and capital in case of wheat. The absolute share, however, increased for all the factors, except capital, in case of jowar, though the magnitude of gain varied.

(Guide : Dr RK Pandey)

2. SINGH, SK—Technological change and its implications for crop production and resource use in Eastern U.P.

The study aims at measuring techno-

logical change in crop production. The effect of improved techniques on resource use and crop production has also been examined. The study is confined to East U.P. and is based on farm level Cross Section data collected under the Cost of Cultivation Scheme. The study indicated that there was a structural break in production relation in the green revolution period in the case of paddy and wheat crops. Gram, rapeseed, mustard did not indicate any structural break in the production relation over the two periods. Per hectare output growth in paddy as the result of introduction of HYV technology over local technology was about 27 percent. The same in the case of wheat was 19 percent. In all the major crops of the region, human labour had positive productivity.

(Guide : Dr RK Pandey)

M.Sc. (Agril. Stat.)

1. BHAR, LAL MOHAN—On missing value estimation in block designs

An experiment starts with a problem, an answer to which is obtained from interpretation of a set of observations collected suitably. Creation of controlled conditions is the main characteristic feature of experimentation. It is the design of an experiment which specifies the nature of control over the operations in the experiments. Proper designing is also necessary for applying least squares analysis suitably which yields estimates of parameters, standard errors for

contrasts of parametric function and ANOVA table. Keeping these in view, a number of designs are developed such as Randomised Block design, Latin Square Design etc. However, with the development of the subject some more complicated designs come into existence to cope up with more complicated experimental situations. Balanced Incomplete Block Designs, Partially Balanced Incomplete Block Designs are among them which possess some desirable design properties. It may sometimes happen that due to some unforeseen causes, observations from some of the plots are missing. When missing observations occur, the least squares analysis becomes complicated. For example due to missing values 'balance' present in the original design is destroyed. However, an intuitively attractive approach is to fill in the missing values to restore the original design pattern and then proceed with the standard analysis. The present thesis deals with this problem. Among several methods available Yates method has been taken to estimate the missing values. This method fails to agree with the correct treatment sum of squares in the analysis of variance. It is slightly larger than the one obtained from the available data. However, this bias can be calculated and consequently treatment sum of squares get corrected. Moreover variances of various treatment contrasts will also be changed according to the positions of the unaffected treatments. This thesis deals with all these aspects, espe-

cially concerning the positions of the unaffected treatments while finding out the variance of treatment contrasts. At first explicit expressions for estimating missing observations, corrected treatment sum of squares, bias and variances of the estimates of various treatment contrasts for one missing observations are obtained binary variance Balanced Designs with unequal replications and unequal block sizes, group-divisible Designs and Youden Square Designs. Then this study is extended to obtain the estimates of two missing observations in a Binary variance Balanced Designs with unequal replications and unequal block sizes. Some existing examples have been taken to study with the missing observations.

(Guide : Dr VK Gupta)

2. PAUL, AMRIT KUMAR--Empirical study of different selection strategies for genetic improvement

Simultaneous selection based on multiple traits is very useful technique of bringing improvement in the net merit of the individual both in plant and animal breeding experiments. There are several methods to achieve this objective and depending upon the different situations, the efficiency of different selection procedures vary. In one situation, one method is better than other and in the other situation, it may not perform to the expectation. Though in literature, various procedures have been discussed by highlighting the merits and demerits of each of the method. In most of the procedures, their theoretical comparisons

are made and necessary conditions have been identified under the principle of efficiency of one procedure over the other. There are, however, procedures available in the literature whose theoretical comparisons are not available and also not possible to compare theoretically because of non-availability of explicit solutions. With this in mind, the present investigation has been undertaken to examine empirically the performance of three different selection strategies viz. Selection Index, Phenotypic Index and Transformed Culling method.

In order to achieve this objective, two sets of real data reported in Narain et al (1979) have been used for the present study. The one set real data taken into consideration is for fitting of an overall selection index based on different characters and other set of real data is used for studying the different selection strategies with an aim to have improvement in the character of interest. In addition to these two sets of real data, with given values of genetic and phenotypic parameters have also been used. Although there are vast practically unlimited number of combinations, but only few important ones have been taken into account. The situation of two and three characters has been considered for empirical comparison by using all the three methods of selection. The fitting of selection index is carried by following the theory of Fisher (1936) and Hazel (1943) whereas fitting of phenotypic index is carried out by using the methodology given by Narain and Mishra

(1975). The methodology of transformed culling as given by Xu and Muir (1991) has been used.

The estimate of economic gains along with relative efficiencies of pair-wise comparisons of the three selection strategies are obtained under the real life data and as well as under various hypothetical combinations of pre-assumed genetic and phenotypic parameters. The results based on one of real life situation proved the superiority of selection index. In the another set, though the selection index is the optimum selection strategy for multi-trait selection, but the results on transformed culling method are also very encouraging in the sense that relative efficiency of transformed culling in comparison to selection index at a 0.20 proportion is 97-79 per cent. This establishes the closeness of transformed culling with selection index.

In the case of empirical comparisons based on pre-assumed genetic and phenotypic parameters, the only observation drawn from the results is about the superiority of selection index procedure, though the estimates of economic gains based on phenotypic index and transformed culling are equally good and relative efficiencies are in the close neighbourhood of 100 percent. Another interesting observation from the results is that the estimates showed continuous increasing trend with the increase in the value of heritability of the main trait. The results also proved that the response due to selection is inversely proportional

to proportion of selection, as the results, in all the situations, based on one per cent of selection are significantly greater than the corresponding at 50 per cent selection. Finally, it is concluded from the emperical results that response is affected by large number of genetic and phenotypic parameters and it is a very difficult task to examine and quantify the effect of each of the different genetic and phenotypic parametrrers. Besides all these odds, the performance of selection index is undoubtedly better than any other selection strategy. If the cost consideration and saving of resources, are in the back of one's mind then transferred culling is equally good or even better than the conventional selection method. The interesting feature of transformed culling is that with the advent of modern super computers, explicit situation are available. In the cases, where no prior knowledge of genetic parameters is available, then in those situations, it is advisable to use phenotyhpic index because of its ease in fitting and nearly as efficient as selection index.

(Guide : Dr VK Bhatia)

3. RAO, AR—On procedures for studying non-linear genotype environment interactions

This dissertation is mainly concerned with a critical evaluation of various regression procedures currently employed in the analysis of non-linear GE interactions and related stability/adatability measurements and the interrelationships among common stability parameters.

The introductory chapter of the dissertation gives the motivation for taking up the present investigation on non-linear GE interactions. In the second chapter a critical review of past work in the area of GE interactions and stability parameters is provided to gain insight into the existing gaps.

The third chapter is devoted to a critical evaluation of the regression procedures for studying non-linear GE interactions and the related stability assessment using live data on horticultural crops. A method of overcoming the drawback of the two-phase regression approach of Verma *et al.* (1978) is also proposed in this very chapter.

The last chapter deals with some useful interrelationships among common stability parameters. The dissertation is concluded with a summary.

(Guide : Dr VT Prabhakaran)

4. VENUGOPALAN, R—Studies on length — weight relationship in fisheries.

Mathematical models play an important role in fisheries.

Chapter I deals with a detailed description of different types of mathematical models. In fisheries, the study of the relationship of length and weight is an important diagnostic indication of the well-being of fish and serves two fold purposes :

- (a) to provide a mathematical relationship between the variables.
length and weight,

- (b) to measure the variation from the expected weight for length of individual fish or group of individuals as an indication of fatness, general well being or gonadal development.

The available literature on length-weight relationship in fisheries, is critically reviewed in chapter II. The relationship is expressed by means of a nonlinear model, i.e., one in which atleast one of the parameters appears in a nonlinear manner. However, the procedure followed in these studies suffer from a number of drawbacks, some of which are :

- (a) Instead of employing nonlinear estimation procedures, method of least squares is used for the linearized version.
- (b) Coefficient of determination, R squared is incorrectly used to measure the goodness of fit of the original nonlinear model.

As it is not possible to solve exactly the resulting normal equations of a nonlinear statistical model, various iterative procedures like Taylor series method, Steepest descent method and Levenberg-Marquardt method are studied thoroughly in Chapter III. Relative merits and demerits of these procedures are used to obtain the length-weight relationship in *Scoliodon laticaudus*. It is found that Levenberg-Marquardt method converges quite fast

to the parameter values. The goodness of fit of the model is examined by calculating the value of R squared in addition to three more statistics viz., RMSE, MSE and MAE. Examination of residuals is also done by using the 'Run Test'. Finally, to get an idea as to how different the estimates of the parameters and values of different statistical measures are if the commonly used linear estimation procedure is employed, a comparison between nonlinear and linear estimation procedures are made. Based on all these considerations, it is concluded that for estimating the nonlinearly related parameters of the model describing the length-weight relationship in *Scoliodon laticaudus* fish species, nonlinear estimation procedure is not only appropriate but also provides better results.

(Guide : Dr Prajneshu)

**5. WALKE, RAJENDRA DINKAR—
Some investigations on inadmissible
estimates of heritability.**

This dissertation is chiefly concerned with the comparison of some of the logistic transformation estimators of intra-sire regression heritability as also with the study of the probability of inadmissible estimates of this parameter through simulation. In this study four estimators proposed by Prabhakaran and Jain (1990) were taken and compared with the help of simulated data with regard to bias and variance. Empirical probabilities of inadmissible estimates have been obtained assuming

additive gene action model and compared with the theoretical probabilities reported earlier.

The first chapter gives brief account of different procedures of estimation of heritability, the frequent occurrence of inadmissible estimates, inadequacy of estimation procedures in so far as obtaining admissible estimates of the parameter and the motivation to take up the present investigation.

Chapter II provides a critical and comprehensive review of past work on the subject with greater emphasis on work related to occurrence of inadmissible estimates and methods of obtaining admissible estimates of heritability.

Chapter III deals with material and methods used in the present investigation and the salient findings. A brief description of simulation techniques used in the generation of data and analysis of data to achieve the objectives of study has been provided. The various estimators used in the study were h^2RR , h^2R1 , h^2R2 and h^2R3 . On these, h^2R3 was found to be more consistent in giving a reliable estimate of heritability. As regards the probability of inadmissible estimates these are shown to be in agreement with the theoretical probabilities.

(Guide : Dr VT Prabhakaran)

M.Sc. (C.A.A.)

1. BADGE, RAVI KUMAR : Decision Support System for Orange Growers of Maharashtra.

Decision support systems and expert

systems can be of tremendous help to guide people engaged in modern agriculture. These system usually provide decision support either for extension agents, who have to decide what advice to offer to clients, or for farmer/orchardists who have to decide what action has to be taken. Since farmers/orchardists are unlikely to accept computer packages as complete substitute, for experienced advisors, the system can be expected to perform alongside humans for sometime to come. Therefore, there is more scope of development of decision support systems in agriculture.

Fruits form a complete, wholesome food for the grownup, still growing and the invalids alike, leading to healthy body and mind. It is a ready source of energy with the unique capacity to guard against many deficiency diseases. Citrus fruits are ranked third after mango and banana. Various citrus fruits are popular and sweet orange is most liked amongst them. Every year the orchardists are suffering from loss/heavy loss due to diseases, insect-pests or improper care. The increasing demand for cheap and more orange fruits of high quality justifies stress on increased production to strengthen the supply line by interweaving the different principles with the established practices. Keeping in view the sweet oranges importance and loss incurred the problem of developing a computer aided system was undertaken. The development of the system was started with following objectives :

- (i) To design and develop a user friendly computer software by organising a knowledge base about orchard diseases, pests, irrigation requirement etc. of citrus crop.
- (ii) To provide appropriate recommended control measures and fertilizer requirement.

Information and knowledge for the system was gathered from various books and journals and experts. Keeping in view the above objectives a decision support system for orange growers was developed using expert system techniques. Rules were used to construct a knowledge base for this system. The system was programmed in PROLOG. The system also includes the description of valuable information.

The system was developed as a menu driven user friendly software. It puts queries/menu to the user for selecting options and answering queries. The use of this system will provide intellectual support to farmers and extension workers in knowing important diseases, pests, fertilizers requirement, irrigation requirement, economic production, future market etc.

The system was developed as a thesis requirement with constraints such as time. Therefore, it was not possible to develop the system beyond that of a working prototype. Further development of the system can be undertaken in various ways in future.

* A graphical interface may be included in the system to diagnose the plant damage symptoms and better output generation for recommendation and advice. It will be better to display the figures of insect to support insect pest identification.

* A research project may be undertaken to reduce the number of questions to be answered by the user.

* Different other orange growing zones as well as other citrus fruits can also be included.

* Natural processing techniques may be incorporated in the system to describe the user's problem in a natural way since the system provides a query interface to describe the problem. In this situation user has to describe in the form 'y' or 'n'. If natural language interface is incorporated in this system, user will be able to describe his problem using a natural language. He will be required to answer very few questions by hitting 'y' or 'n'.

* 'How' explanation and 'why' explanation may be included in the system.

* Inclusion of a judgement facility to deal with imprecise or missing information e.g. not all tree damage symptoms may be evident or damage may also be result of nutrient deficiency.

* A comprehensive evaluation of the system can be undertaken.

(Guide : Sh Mahesh Kumar)

2. BASAK, SATYANANDA—Development of a computerized information system for monitoring research project files

Each year a number of ICAR projects are run in Institutes as in IASRI. After the project proposal is passed in SRC i.e. Staff Research Council it is presented in the form of RPF-I. It gives information about project title, subject title, list of scientist involved, objective, practical utility, cost, facility etc. Yearly progress is presented in RPF-II. It contains information like Annual Report on the project, list of publications, seminars and workshops delivered by the related scientists etc.

Monitoring Cell of IASRI also collects information on progress of projects half yearly which gives quantitative informations like state of the project, stage of report with date, receipt of schedule—transcription—statistical analysis—report all in percentage basis of target achievement, and reason for gap. On the basis of RPF's and half yearly progress reports a summary of report is prepared which is distributed to Scientists and Director. Finally when the project is completed RPF-III is filled up. RPF-III contains informations like list of subprojects and experiments conducted, observations undertaken, final report on the project etc.

Objectives have been to (i) study the existing monitoring and RPF-proformas, (ii) development of a suitable interactive user friendly software, (iii) implementa-

tion of the software using current research projects of IASRI.

A database has been generated based on these RPF-proformas and the Monitoring Cell proforma of IASRI. In designing the database model first the overall functional dependency diagram was observed carefully. Through the process of normalisation this diagram was decomposed to reach upto 4NF. At this stage it was left with seven relations. Each of these seven relations were kept into seven different base tables namely scientist, work, project, keyword, annual, F project, monitor using the structured query language of oracle RD & MS.

Next step a software is prepared which will operate on these base tables created earlier. Fourth generation language is used in preparing the software. In a 4GL we need to specify the objective and leave the system to work out the steps. Here embedded SQL statements are used within the program in language C. The software can generate reports like RPF-I, RPF-II, RPF-III. Summary of progress report and a number of queries.

(Guide : Sh SN Mathur)

3. JAIN, AJAY KUMAR—Software for predicting the pesticide concentration at different soil depths.

Most of the pesticides/herbicides are spread in the form of the solution prepared generally in the water. The applied chemical then redistributes itself to different depths depending on different

factors. These factors are soil characteristics—soil ph, organic matter, soil moisture etc, amount of infiltrating water and types of pesticides/herbicides. Subsequent irrigation or rainfall will leach the active substance into much deeper layer and may sometimes even into ground water. Therefore a quick knowledge on whether a pesticide is agronomically available for which purpose it was applied or polluting the ground water. Due to its persistence, it is essential for proper management of pesticide application.

In studies carried so far, different linear and non-linear curve fitting models and computer programs on these models have been developed to describe the movement of pesticides/herbicides/fertilizers. However, linear models show severe deviations from real experiment data, whereas non-linear models could not predict the early arrival of the pesticides/herbicides. Therefore, there was a need to develop a better approach or functional relationship.

The curves which were obtained for different parameter values of the Bessel's function and the curves from the real experiments data show a lot of similarities.

Therefore, software for predicting the pesticides concentration at different soil depths was developed using Bessel's function of first kind.

A software entitled "PESTCON" was successfully developed which can be used

to predict the pesticides/herbicide concentration at different soil depths under laboratory conditions. At present this software predicts the Atrazine concentration upto 30 cm soil depths. This was due to unavailability of data for other pesticides/herbicides. Although facility has been incorporated in the software to fit the relationship for given data. Attempts has been made to develop a user friendly software. The software is menu driven and is provided with help screen at each menu level, It has two modules.

1. *Predict* : This module is developed to predict the pesticide/herbicide concentration at different soil depths. It utilizes the relationship which is already stored in the database.

2. *Fit* : This module is for fitting a relationship to the data supplied by the user on depth in centimeter and corresponding pesticide/herbicide concentration in microgram on different amounts of infiltrating water. This fitted relationship is than stored in the database for further use. In this module facility is also provided for manipulating the database.

(Guide : Sh SN Mathur)

4. SANTOSH MITHRA, VS—A simulation optimisation approach for predicting aphid population.

Aphid infestation cause serious damages to mustard crop by which its yield is reduced considerably. So models to predict aphid population on mustard crop is very important. By recent re-

search efforts a lot of models have been developed for this purpose,

After critical review of a number of literature, it is found that the models developed so far for the prediction of aphid population are not able to give good results under an environment different from the one in which it is made. Under these circumstances there is a great need for a suitable technique to make adjustment in the model to make it suitable for all environmental conditions.

After the critical review of literature a suitable algorithm for parameter optimisation of models was found out. The algorithm is a simulation optimisation technique. The models for predicting aphid population were also taken from the different literature available. Field data about aphid population were also taken from the literature.

A user friendly software was developed for improving the aphid population prediction using these models. The improvement was done using the Fibonacci algorithm which is doing the optimisation by on-line parameter adjustment.

(Guide : Sh R Gopalan)

5. SINGH, DHARAMVIR—Computer based diagnosis system for important diseases, insect—pests and physiological disorders of mango crop.

Diagnosis system development potential exist in agriculture and farm mana-

gement. Expert system technology promises to provide important research and extension tools for agriculture in the future. Expert system may also play a significant role in the education of farmers and extension workers, by providing an insight in to how agricultural experts solve problems. They can be used to help the farmers, farm managers and extension workers. Most of the farmers take action against plant damage at a time when loss of crop is considerably more. A large amount of loss can be minimized or reduced to some extent by taking timely action. Diagnosis system are such type of tool which if available to farmers can prevent the problem become worse. They can play a significant role in diagnosing diseases, insect-pests and physiological disorders in crops. Farm manager as one of the user of diagnosis systems who can use them for better crop management. Extension workers may use them for performing extension-service work efficiently.

Through the medium of expert systems the knowledge of researchers can be made available to farmers implicitly. In this way the knowledge and research which is limited to laboratories can be directly applied to the field. But the problem in diagnosis system is the great complexity and time consuming nature of the process. Therefore, selection of foremost application field must be performed carefully and analysis of expected utility should be required. One such

field of application of diagnosis systems identified was diagnosis and control of diseases, insect-pests and physiological disorders in mango.

The problem for developing a diagnosis system which will be able to diagnose the diseases, insect-pests and physiological disorders of mango crop and recommend control measures also, was taken with the following objectives :

1. To organise a knowledge base about the plant damage symptoms caused by insect-pests, diseases and physiological disorders.
2. To recommend appropriate control measures.
3. To design and develop user-friendly software.

Keeping in view the above objectives, a rule-based diagnosis system entitled Computer-based Diagnosis System for Important Diseases, Insect-pests and Physiological Disorder of Mango crop, was developed. Rules were used to construct a knowledge base for this system. The knowledge for identification and control of insect-pests, diseases and physiological disorders derived from written sources was efficiently captured in this rule-based system. Knowledge engineering techniques were used to diagnose the diseases, insect-pests and physiological disorders and control advice to user. Question-Answer interface was used to put queries for the user

and give advice to user. The diagnosis system similar to this developed system would allow farmers and extension workers rapid access to expert advice about the identification and control of economically important insect-pests, diseases and physiological disorders.

Future development of this system may involve :

1. A graphical interface may be included in the system to diagnose the plant damage symptoms and better output generation for recommendation and advice. It will be better to display the figures of insects to support insect-pests identification.
2. A research project may be undertaken to reduce the number of questions to be answered by the user.
3. Natural processing techniques may be incorporated in the system to describe the user's problem in a natural way. Since this system provide a question-answer interface to describe the problem. In this situation user has to describe the problem in the form of 'y' or 'n'. If natural language interface is incorporated in this system, user will be able to describe his problem using a natural language. He will be required to answer very few questions by hitting 'y' or 'n'.

4. 'how' explanation and 'why' explanation may be included in the system.
5. Inclusion of a judgement facility to deal with imprecise or missing information, e.g. not all plant damage symptoms may be evident or damage may also be result of nutrient deficiency.

(Guide : Sh Mahesh Kumar)

6. VERMA, ROHIT—Software for prediction of *Rhizobium* variability

Maintaining the quality of legume inoculants between production and application is an important factor in the the successful use of inoculants.

The present study was planned to develop an interactive software for rapid prediction of quality of inoculants stored under laboratory conditions and for maintaining a database for the same. The software so developed, MICRO-FIT, has 3 modules.

PREDICT, FIT, GENERATE

PREDICT modules is for predicting the *Rhizobium* viability at a given period of storage utilizing the relationships stored in the database corresponding to a combination of strain, carrier and temperature of storage.

FIT module is for fitting a relationship to the data applied by the user on period in days and the corresponding viability measured as number of cells per gram of carrier. This fitted relation-

ship is then stored in the database for further use.

GENERATE module is for generating the experimental data, based on normality assumption, fits a quadratic relationship to it and stores it in the database.

MICRO-FIT has a friendly Human Computer Interface which has been designed for users who are novices or

having very little knowledge of computers as such. Help has been provided at all levels in the form of a single screen display. The point and pick interface used in menus minimizes typing efforts and increases interaction efficiency.

The database provided with this software consists of relationships fitted on data available in division of Microbiology, IARI.

(Guide : Sh R. Gopalan)

SEMINARS/WORKSHOPS/SYMPOSIA AND CONFERENCES ATTENDED BY THE SCIENTISTS

Sl. No.	Names of the Scientists	Programme Title	Place	Period
1	2	3	4	5
1.	Sh SP Bhardwaj	75th Annual Conference of Indian Economic Association	Indore	May 1-3
2.	Dr PS Rana	Symposium on 'Probability and Statistics'	Kerala University, Trivendrum	Jun 9-11
3.	Dr RK Pandey Sh Shanti Sarup	Seminar on Creativity in Scientific Research	National Institute of Science, Technology & Development Studies, New Delhi	Aug 2
4.	Dr RK Pandey Dr VK Sharma	Workshop on 'Status of the on going Research in Agricultural Economics at various ICAR Institutes/Centres'.	National Centre for Agricultural Economics and Policy Research, New Delhi	Sep 21-22
5.	Dr GC Chawla	Symposium on Statistics and its Application	INSA	Oct 14
6.	Dr BC Saxena Dr R Prasad	International Symposium on 'Optimization and Statistics'.	AMU, Aligarh	Nov 2-4
7.	Dr RK Pandey Sh KC Bhatnagar Sh Shanti Sarup	International Symposium on 'A Decade of Potassium Research'	Taj Palace Hotel, New Delhi	Nov 18-20

1	2	3	4	5
8.	Dr RK Pandey Sh Ashok Kumar	53rd Annual Conference of Indian Society of Agricultural Economics	PAU, Ludhiana, Punjab	Dec 2-4
9.	Sh RS Khatri	National Seminar on 'Quality Control : ISO-9000' organized by Indian Dairy Association	Ashoka Hotel, New Delhi	Dec 4-5
10.	Dr VK Sharma	FAI Seminar on 'Emerging Scenario in Fertilizer and Agriculture-Global Dimensions'	Ashoka Hotel New Delhi	Dec 6-8
11.	Dr OP Kathuria** Dr PR Sreenath Dr Shiytar Singh** Sh TB Jain Dr VK Bhatia* Dr GC Chawla Sh KC Bhatnagar Sh Jagmohan Singh Dr Jagbir Singh Sh Satya Pal Sh Madan Mohan Dr Anil Rai	47th Annual Conference of Indian Society of Agricultural Statistics	SV Agril. College, APAU, Tirupati	Dec 16-18
12.	Dr RC Jain	Eighty First Session of Indian Science Congress	Jaipur	Jan 03-08
13.	Dr GC Chawla	National Conference on 'Modernisation of Draught Animal Power System'	Vigyan Bhawan, New Delhi	Mar 04-05
14.	Sh RS Khatri	XXV Conference of Dairy Industry organised by IDA	Ashoka Hote New Delhi	Mar 24-25

* Convened a session on Statistical Computing during the conference.

** Participated in the symposium 'Improvement of Livestock Statistics' organised during the conference.

PAPERS PRESENTED AT WORKSHOP/SYMPOSIA AND CONFERENCES

Sl. No.	Author(s)	Paper Title	Programme Title	Venue	Period
1	2	3	4	5	6
1.	Pandey, RK Bhardwaj, SP	A case for privatisation of fertilizer industry in India	The 75th Annual Conference of Indian Economic Association	Indore	May 1-3
2.	Bhardwaj, SP	Ranade and his economic nationalism	"	"	"
3.	Rana, PS	A queueing model for local area computer network	Symposium on 'Probability and Statistics'	Kerala University, Trivendrum	Jun 9-11
4.	Pandey, RK Rai, SC Shanti Sarup	Creativity and environment in agricultural research in Indian context	Seminar on Creativity in Scientific Research	National Institute of Science, Technology and Development Studies, New Delhi	Aug 2

1	2	3	4	5	6
5.	Pandey, RK	Activities of division of Statistical Economics at IASRI	Workshop on 'Status of the ongoing Research in Agricultural Economics at various ICAR Institutes/centre'.	National Centre for Agricultural Economics and Policy Research, New Delhi	Sep 21-22
6.	Prasad, R Gupta, VK	A-Optimality of group divisible designs with unequal block sizes for making test treatments control comparisons under a heteroscedastic model.	The 2nd International Symposium on 'Optimization and Statistics'	A.M.U., Aligarh	Nov 2-4
7.	Saxena, BC Srivastava, AK	Optimization in multiple frame surveys with multi character study.	"	"	"
8.	Pandey, RK Bhatnagar, KC Verma, LM Gupta, VK	Role of potassium in maximising foodgrain production during nineties.	International Symposium on 'A Decade of Potassium Research'	Taj Palace Hotel, New Delhi	Nov 18-20
9.	Pandey, RK Ashok Kumar	Economic study of agricultural wages, output and productivity in Orissa	The 53rd Annual Conference of Indian Society of Agricultural Economics	PAU, Ludhiana, Punjab	Dec 2-4
10.	Pandey, RK Bhardwaj, SP	Analysis of minor forest produce—A case study of Shellac trade in India	"	"	"

1	2	3	4	5	6
11.	Arya, SN Singh, Shivtar	Prevalance of morbidity among ovines in a rural area	The 47th Annual Conference of Indian Society of Agricultural Statistics	SV Agricultural College (APAU Campus), Tirupati	Dec 16-18
12.	Bathla, HVL Singh, Padam*	On probability proportional to size sampling	"	"	"
13.	Bhatia, VK Paul, AK* Wahi, SD	Empirical comparison of different selection strategies for genetic improvement	"	"	"
78	14. Chawla, GC	Two-period cross over for animal clinical trials	"	"	"
15.	Chawla, GC Gupta, VK	Two factor change over design based on Williams squares	"	"	"
16.	Jain, TB Kathuria, OP Srivastava, AK Natraja, N*	Estimation of production of mulberry leaves in Bangalore district	"	"	"
17.	Jain, TB Rawat, PS* Riyazuddin* Sharma, SC*	On structure of sheep population in Tonk district of Rajasthan	"	"	"

1	2	3	4	5	6
18.	Jayasankar, J* Bhatia, VK	On use of bootstrapping for estimation of confidence intervals of heritability	”	”	”
19.	Madan Mohan	Performance of new wheat varieties and optimum fertilizer requirement in relation to dates of sowing	”	”	”
20.	Madan Mohan Singh, BH	Integrated model in forecasting the yield of groundnut	”	”	”
21.	Rai, Anil Rai, T Mohan Lal Phool Singh*	Use of log-linear models in census	”	”	”
22.	Sarup, Shanti Rai, SC*	Study of changes in land holdings and resource endowments	”	”	”
23.	Satya Pal	Seed, feed and wastage rates of bajra and gram crops in Rajasthan	”	”	”
24.	Satya Pal	Study to compare the efficiency of different sources of nitrogen	”	”	”

1	2	3	4	5	6
25.	Satya Pal	Comparative study of additional response of rice to different sources of phosphorous in rice-wheat sequence	”	”	”
26.	Singh, Jagbir Kathuria, OP	Estimation of parametric function in repeat surveys	”	”	”
27.	Singh, Jagmohan Singh, BH	Effect of rain fall distribution on the yield of groundnut during its growth period	”	”	”
28.	Singh, Jagmohan Singh, BH Mathur, DC	A study on yield of paddy under different scenarios of occurrence of flood	”	”	”
29.	Singh, Shivtar Bhatia, DK Kumar, Devendra	Small area estimation of buffalo milk	”	”	”
30.	Srivastava, AK Khosla, RK* Narain, Prem* Gupta, HC	Harvest and post harvest foodgrain losses	”	”	”
31.	Kathuria, OP	Some issues relating to sampling methodologies of livestock surveys	Symposium on Improvement of Livestock Statistics organised during the above conferenee	”	”

1	2	3	4	5	6
32.	Singh, Shivtar	Cost of production of live-stock products	„	„	„
33.	Bhardwaj, SP	A study on production efficiency of hand made shellac production units	National Seminar on Agri-business	HAU, Hissar	Jan 19-20
34.	Bhardwaj, SP	Economics of health status in rural areas—A micro level study	The 76th Conference of the Indian Economic Association	Bombay	Feb 19-21
35.	Jain, RC Agrawal, Ranjana	Objective method for crop yield forecasting and their use in national development	Symposium on Role of Statistics in National Development in the session of Statistics in Eighty First session of Indian Science Congress	Jaipur	Jan 03-08
36.	Jain, RC Garg, RN* Singh, Gurcharan* Agrawal, Ranjana	Model for rice yield forecast using agro-spectral data	Symposium on Role of Statistics in National Development in the session of Agricultural Sciences in Eighty First session of Indian Science Congress.	Jaipur	Jan 03-08

* Student of the Institute and Scientists from other Institutes.

OTHER INFORMATION ABOUT SCIENTISTS

Membership of Scientific Societies

—International Association of Survey Statisticians

Dr OP Kathuria

—Indian Society of Agricultural Economics, Bombay

Dr RK Pandey, Sh TB Jain, Dr PK Batra and Sh SP Bhardwaj

—Indian Society of Agricultural Statistics, New Delhi

Dr OP Kathuria, Dr HP Singh, Dr BS Sharma, Dr AK Srivastava, Dr PC Mehrotra, Dr Shivtar Singh, Dr Randhir Singh, Dr (Mrs) Ranjana Agrawal, Dr HVL Bathla, Dr VK Gupta, Sh TB Jain, Dr SS Shastri, Dr RC Jain, Sh Shanti Sarup, Dr Basant Lal Choudhary, Dr NK Ohri, Sh RL Rustagi, Dr GC Chawla, Dr VK Bhatia, Dr PK Malhotra, Sh MS Batra, Dr DL Ahuja, Sh SN Arya, Sh SD Wahi, Sh KPS Nirman, Sh Lal Chand, Sh Jagmohan Singh, Dr PS Rana, Dr PK Batra, Dr SP Verma, Sh RS Khatri, Sh KC Bhatnagar, Sh DC Mathur, Sh GL Khurana, Sh Balbir Singh, Dr Jagbir Singh, Sh BH Singh, Sh JP Goyal,

Sh DK Bhatia, Sh SC Sethi, Sh MS Narang, Mrs Ajit Kaur Bhatia, Sh T Rai, Sh Satya Pal, Sh VK Jain, Sh K Chugh, Dr Anil Rai, Dr (Km.) Seema Jaggi and Dr Rajendra Prasad.

—Computer Society of India, Bombay
Sh SN Mathur, Sh Mahesh Kumar, Dr PK Malhotra and Dr RC Goyal

—Indian Association of Statistics and Applied Research, Hisar

Dr HP Singh and Sh RS Khatri

—Biometric Society, Washington, USA
Dr BS Sharma

—Indian Econometric Society, Delhi

Dr VK Sharma

—International Statistical Institute, Netherlands

Dr VK Gupta

—Indian Society of Agricultural Science, New Delhi

Dr GC Chawla, Dr VK Bhatia, Mrs Ajit Kaur Bhatia, Sh T Rai and Sh Satya Pal

—Society for Information Sciences, New Delhi

Sh Mahesh Kumar

—Indian Academy of Social Sciences,
Allahabad

Sh Shanti Sarup

—Indian National Science Academy,
New Delhi

Dr PK Batra

—Federation of Agricultural and Allied
Services Association, New Delhi

Sh SN Arya

--Acta Cincia Indica

Dr PS Rana

—Indian Dairy Association

Sh RS Khatri

—Indian Society for Medical Statistics,
New Delhi

Dr Jagbir Singh

--Indian Economic Association

Sh SP Bhardwaj

Offices in Professional Societies

—Vice-President, Indian Society of
Agricultural Economics, Bombay

Dr RK Pandey

—Members. Executive Council, Indian
Society of Agricultural Statistics,
New Delhi

Dr OP Kathuria, Dr AK Srivastava and
Dr VK Bhatia

Membership/Offices of Committees/Panels/ Working Groups

—PG Faculty Members of PG School,
IASRI, New Delhi

Dr OP Kathuria, Dr RK Pandey, Dr
PR Sreenath, Dr HP Singh, Sh SN
Mathur, Dr Prajneshu, Dr AK
Srivastava, Sh R Gopalan, Dr PC
Mehrotra, Dr BS Sharma, Dr Randhir
Singh, Dr VK Sharma, Dr (Mrs.)
Ranjana Agrawal, Dr HVL Bathla, Dr
BC Saxena, Dr VT Prabhakaran, Dr VK
Gupta, Sh Mahesh Kumar, Dr RC Jain,
Sh OP Dutta, Dr GC Chawla, Dr VK
Bhatia, Dr PK Malhotra, Sh SD Wahi,
Dr PS Rana, Sh BH Singh, Dr R
Srivastava

—Board of Studies, Agricultural Econo-
mics, Banaras Hindu University,
Varanasi

Dr RK Pandey

—Members Management Committee of
IASRI

Dr PR Sreenath, Dr AK Srivastava, Dr
VK Gupta and Dr UN Dixit

—Editorial Board, Journal of ISAS,
New Delhi

Dr AK Srivastava

—Academic Council of PG School of
IASRI, New Delhi

Dr Randhir Singh and Sh Mahesh
Kumar

—Standing Committee on Courses,
curricula and Academic Affairs, PG
School, IASRI, New Delhi

Dr Randhir Singh

—Secretary, Staff Research Council,
IASRI, New Delhi

Dr HVL Bathla

—Indian Science Congress Association,
Calcutta

Dr RC Jain and Dr Rajendra Prasad

—Technical Committee Member on
Progeny Testing Programme in
Maharashtra

Dr VK Bhatia

Special lectures, Training and Meetings

Dr RK Pandey

—Chaired the meeting of Technical
Committee of Direction for Improve-
ment of Animal Husbandry and
Dairying Statistics, at IASRI
New Delhi from Oct 7-8

—Attended

- * The meeting pertaining to preli-
minary discussion by group of
experts on 'Quality of Agricultural
Statistics', Ministry of Agriculture
on Apr 20
- * The meeting of Executive Com-
mittee of Gramin Kshetriya Vikas
Parished held at IASRI on Apr 27
- * The meeting of Research Advisory
Committee of NARP-II in ICAR
on May 10 and Nov 17
- * The Meetings of Academic Council
of IARI, New Delhi on Aug 7,
Sep 1, Oct 12 and Feb 10
- * Director's meeting of ICAR
Institutes at New Delhi from
Oct 5-6

* The Group Discussion Meeting of
Agro-Forestry Scientists at IASRI
from Oct 11-12

* The meeting of Farm Accounts
Sectional Committee at Bureau of
Indian Standards on Oct 12

* The meeting of ICAR Regional
Committee No. IV at Indian
Institute of Sugarcane Research,
Lucknow from Nov 8-9

* The meeting of the Management
Committee of National Centre for
Agricultural Economics and Policy
Research at New Delhi on Dec 17

—Delivered a lecture on Research and
Training Activities of IASRI to the
ISS Probationers on Mar 18

Dr VK Gupta

—Delivered three lectures on 'Opti-
mality Aspects of Designs' at
Department of Mathematics and
Statistics, HAU, Hisar on Mar 4-5

Dr RC Jain

—Delivered a lecture on 'Crop yield
forecasting' at Indian Institute of
Management, Ahmedabad on Aug 17

Dr RK Pandey, Dr HP Singh, Dr AK
Srivastava, Sh SN Mathur, Dr Shivtar
Singh, Sh Anand Prakash, Sh TB Jain,
Sh RL Rustogi, Dr BC Saxena, Sh
RS Khatri and Sh JP Goyal

—Attended the meeting of 'Technical
Committee of Direction for Improve-
ment of Animal Husbandry and

Dairying Statistics held at IASRI on Sh Balbir Singh

Oct 7 and 8

Dr BC Saxena

- Attended the meeting on Availability and Requirement of Fodder and Forages for Livestock and Poultry—conducted by Animal Husbandry Department, Ministry of Agriculture on Feb 04 at Vigyan Bhavan, New Delhi

Sh OP Dutta

- Attended the Management Committee meeting of IASRI on Sep 24
- Delivered a lecture on 'Challenges ahead in Resource Management' at Institute of Home Economics at University of Delhi on Dec 2

- Attended a meeting of NARP for ON-THE-SPOT progress of the project 'Development of Information System to support Applied Bio-technology Research' at NDRI, Karnal on Jan 13

Sh Ashok Kumar

- Attended training programmes on "Manpower and Employment Planning for National and State level Officers" sponsored by Department of Personnel and Training, Govt. of India at Institute of Applied Manpower Research, New Delhi from Dec 6-11

Participation in ICAR Scientific Panel Meeting

Name of the Scientist	Name of the Scientific Panel	Date
Dr HP Singh	Animal Nutrition and Physiology	July 30

MISCELLANEOUS INFORMATION

Dr RK Pandey

- Attended discussion session on “Priorities of Agricultural Research” at National Centre for Agricultural Economics and Policy Research, New Delhi on Feb 15

Sh SS Gupta

- Secretary (Office side), Institute Joint Staff Council

Dr UN Dixit

- Convenor, Institute Sports Committee
- Secretary, Institute Recreation and Welfare Club

Award Received

Dr Anil Rai

- Received Young Scientist Award of Indian Society of Agricultural Statistics of the year 1993

Foreign Deputation

Dr OP Kathuria

- Worked as FAO Consultant from Apr 15 to May 11 in a research study

on ‘Estimating crop production under mixed cropping’ in Zambia

- Visited Kampala, Uganda as a Commonwealth Secretariat Consultant for the training course on ‘Methodology of Agricultural Sample Surveys, Crop Yield Modelling and Computer programming’ from Jul 6-24

Course Attended

- XX short term training course on “Use of Computer in Agricultural Research” held at IASRI during Sept 1-15

Sh K Chugh, Sh SC Agrawal, Sh Prakash Lal, Sh Parveen Saxena, Smt. Savita Wadhwa, Sh Arvind Kumar, Sh Ram Naresh and Smt Neelam Chandra

- XXII short term training course on “Use of Computer in Agricultural Research” held at IASRI during Mar 16-31

Dr HVL Bathla, Sh Mahender Singh, Sh Om Prakash, Sh Maharaj Swaroop, Sh Rajendra Singh and Nirbhay Pal Singh

COORDINATION AND MONITORING CELL

COORDINATION CELL

This cell is responsible for documentation and dissemination of scientific output of the Institute through IASRI Newsletters, Quarterly Progress Reports, Annual Report, etc. It also organises National Conferences of Agricultural Research Statisticians and meetings of Senior Statisticians of ICAR Institutes and also conducts meeting of Principal Scientists and Head of Divisions of the Institute from time to time.

Reports/Newsletters/Quarterly Progress Reports

- Annual Report, 1992-93
- IASRI Newsletter, Jan-Mar, 1993
- IASRI Newsletter, Apr-Jun, 1993
- IASRI Newsletter, Jul-Sep, 1993
- IASRI Newsletter, Oct-Dec, 1993
- Quarterly Progress Report, Jan-Mar, 1993
- Quarterly Progress Report, Apr-Jun, 1993
- Quarterly Progress Report, Jul-Sep, 1993
- Quarterly Progress Report, Oct-Dec, 1993

Communication of Research Material

ICAR

—Material for inclusion in

- i) ICAR REPORTER (A quarterly publication of ICAR) for the quarters falling due upto March, 1994
- ii) Executive summary for Annual Report of ICAR for the year 1992-93
- iii) Revised detailed material for Annual Report of ICAR for the year 1992-93
- iv) Directory of "Agricultural Research Workers in India"
- v) Directory of ICAR-Scientists
- vi) Six monthly programme of Conferences/Seminars/Symposia/Workshops/Meetings etc. proposed to be held during the periods July-December, 1993 and January-June, 1994

CSO, New Delhi

- Directory of Statistical Officers in India, 1992
- Information for Statistical Systems in India, 1993

*Biotech Consortium India Limited,
New Delhi*

- Information for their Directory of Biotechnology Industries and Institutions in India (Edition-2)

National Social Science Documentation Centre (ICSSR), New Delhi

- Information to update the ICSSR Directory of Social Science Research Institutions in India for UNESCO Directory

MONITORING CELL

The main functions of this cell are to monitor the progress of on-going research projects and bring out half-yearly monitoring report, prepare the Annual Action Plan and Activity Milestone and EFC Memos, prepare the material for creation of data base on research projects of ICAR Research Institutes and to maintain the Research Projects Files for submission to ICAR. The items of work undertaken by the Cell are :

(i) Material prepared and sent to ICAR :

- Annual Action Plan of the Institute as required by DARE for 1993-94
- Detailed document on Annual Action Plan of IASRI for 1993-94
- Material regarding settlement of accounts of all research projects of SSM & ASD and FTCD & P Divisions
- Information regarding Manpower

Requirement for IASRI during VIII Plan

- RPFs for different Divisions for the year 1993 and pending for earlier years

—Annual Plan of IASRI for 1994-95

- Interim reply on project based budgeting

—Modified copies of Part B of EFC Memo of the Institute

- Detailed Material regarding project based budgeting

—EFC Memo for the VIII Plan (1992-97) was further revised in the light of guidelines received from ICAR

(ii) Material sent to Krishi Bhawan, New Delhi

- Information in respect of IASRI regarding performance audit of Division of Animal Sciences, ICAR

(iii) Material distributed among the Heads of Divisions/Sections/Units

- Sanction of the VIII Plan for Part A of the EFC Memo received from ICAR

—Revised guidelines for OIC/EFC procedures received from ICAR

- Monitoring Progress Reports for the six months periods ending March, 1993 and September, 1993

(iv) On the basis of the suggestions received from ICAR and personal discussions, the project based budgeting was under revision

LIBRARY AND DOCUMENTATION SERVICES

Resource Building

As a part of its important activities, library continued its resource collection programme as under :

Total number of publications as on March 31, 1994

Books	—	22731
Hindi Books	—	315
Journals	—	5043
Reports etc.	—	6686

Number of publications added during 1993-94

Books	—	140
Hindi Books	—	6
Journals	—	15
Reports etc.	—	124

Journals subscribed

Indian	—	47
Foreign	—	98

Bulletin/Newsletters received on gratis/exchange : 100

Library Usage

Working Hours : 9.30 A.M. to 4.30 P.M.

Number of readers consulted the library : 30300

Number of publications issued from the library : 27100

Library Users

Number of bonafide library members —350

Number of students (regular) members —20

Number of ad-hoc trainee users —60

Library Services

Number of documents borrowed or lent out on inter library loan basis —95

Number of pages of scientific and technical nature reprographed —50,717

Number of issues of 'Current Content Mirror' brought out —14

Current book reviews —2

Current Awareness Services —2

Library Management

The management of the library is looked after by a library committee with Director as Chairman and Heads of Divisions and Professors as members.

Art and Photography Unit

Art Unit assisted the scientists in preparing diagrams, charts, histograms and maps for research publications and as also visual display of research findings in the exhibition room. It also assisted in transcribing the lectures write-ups on transparencies.

Photographic jobs including expos-

ing, processing and printing of about 500 photographs taken on various important occasions and of important research and extension activities of the Institute were executed. In addition, enlargement of good number of photographs were also done.

The charts and graphs were updated in the light of recent research findings for display in the exhibition room. A number of new charts were also added to the existing ones depicting current research findings. Photographs taken at the special occasions were also displayed. Latest publications were also added.

STAFF WELFARE ACTIVITIES

The Institute has manifold activities for the amenities and welfare for the staff. The major items are detailed below :

JOINT STAFF COUNCIL

The Institute has a Joint Staff Council (JSC) to promote harmonious relations and secure the best means of co-operation between the Council/IASRI as employer and the general body of its employees in matters of common concern for ensuring a high degree of efficiency in the service.

The meetings of the Institute Joint Staff Council were held on July 30-31 and November 22 under the chairmanship of Director of the Institute and various items as per agenda were discussed.

GRIEVANCE COMMITTEE

The Grievance Committee of the Institute (constituted as per ICAR rules) provides the employees a forum to ventilate their grievances relating to official matters and for taking remedial measures.

BENEVOLENT FUND

The employees of the Institute have constituted a Benevolent Fund from

their own contributions to provide relief to the families of the employees who die in harness and are left in an indigent conditions. An amount of Rs. 1053/- was collected in the account of Benevolent Fund contribution from April 1, 1993 to March 31, 1994.

COOPERATIVE THRIFT AND CREDIT SOCIETY

The Society which is registered with the Registrar, Cooperative Societies, Delhi Administration, Delhi continued its activities in the similar manner as during the past years by advancing loans to its members and looking after their welfare. The source of funds of the Society are share money, compulsory deposits and fixed deposits from the members of the Society. The number of members on the roll of the Society on March 31, 1994 was 506.

The election of new Managing Committee was held on August 20, 1993. During the financial year 1992-93, the Society advanced Rs. 2,310,600.00 as loan to its members. During the financial year 1993-94, an amount of Rs. 101/- was given as gift to each of the 4 members on their retirement from the Institute. Financial help was extended from the

members welfare fund to the tune of Rs. 2000 to the breaved family of one member.

COOPERATIVE STORE

The Cooperative Store, registered with the Registrar, Cooperative Societies, Delhi Administration, Delhi, continued to be run for the benefit of the staff members of the Institute. Coffee, cold drinks, snacks, provisions and general merchandise were made available at reasonable rates to the staff members of the Institute. The total membership of the Society as on March 31, 1994 was 402.

RECREATION AND WELFARE CLUB

The Institute has a Recreation and

Welfare Club which provides facilities for indoor and outdoor games, promotes social and friendly relations among the members and looks after the general recreation of its members. The Club also organized sports tournament at the Institute level for different games/events.

SPORTS

ICAR Zone II Sports Meet was organised by CIRB, Hisar during October 18-22, 1993. The Institute's Table Tennis Team comprising of Sh OP Khanduri (Captain), Dr KK Tyagi, S/Shri GM Pathak, SK Upadhyay, KK Hans and PK Saxena won the Championship Trophy. Dr UN Dixit, Sr Scientist was the Chef-de-Mission of IASRI Sports Contingent.

हिन्दी के प्रगामी प्रयोग में प्रगति

प्रतिवेदनभाषीन वर्ष के दौरान संस्थान में नियमित क्रिया कलाओं के साथ-साथ हिन्दी दिवस/वार्षिकोत्सव दिनांक 14 सितम्बर, 1993 को हिन्दी दिवस के दिन ही मनाया गया।

दिनांक 20 अगस्त से 9 सितम्बर 1993 तक 15 कार्य दिवसों का हिन्दी व्यवहार पखवाड़े का आयोजन किया गया। इस अवधि के दौरान विभिन्न प्रशासनिक अनुभागों एवं वैज्ञानिक प्रभागों ने पखवाड़े को सफल बनाने में अपना बहुमूल्य सहयोग दिया। प्रतियोगिताओं एवं पखवाड़े से हिन्दी के प्रयोग में हर वर्ष नये आयाम जुड़ते हैं। प्रत्येक वर्ष अपना कार्य हिन्दी में ही उत्साहपूर्वक करने वाले अधिकारियों/कर्मचारियों की सहया में निरन्तर वृद्धि हुई है। चलाये गये “व्यक्तिगत संपर्क अभियान” के परिणामस्वरूप अधिकारी अनुभागों के कर्मचारी अपना अधिकतर कार्य हिन्दी में ही करके व्यक्तितगत तौर पर और अनुभाग के लिए चल शीलड प्राप्त करने के भरसक प्रयत्न किए और इस वर्ष निष्ठापूर्वक को चलशीलड का निर्णय लेने में काफी सोच-विचार करना पड़ा।

सदैव की भांति इस वर्ष भी पखवाड़े के दौरान संस्थान के वैज्ञानिकों, तकनीकी एवं प्रशासनिक वर्ग के अधिकारियों/कर्मचारियों में हिन्दी प्रयोग के प्रति प्रतियोगी भावना एवं रूचि को प्रोत्साहित करने के लिये कई

प्रतियोगिताओं का आयोजन किया गया जैसे— हिन्दी अनुवाद, हिन्दी लेख एवं निबन्ध, हिन्दी टिप्पण एवं प्रारूपण, हिन्दी टंकण एवं आधुनिक, हिन्दी वाद-विवाद, हिन्दी अन्तर्क्षरी, हिन्दी काव्य-पाठ, हिन्दी गोष्ठी, हिन्दी प्रश्नपत्र प्रतियोगिता। इन प्रतियोगिताओं में विशेष रूप से यह देखने में आया है कि काव्य-पाठ प्रतियोगिता में वैज्ञानिक वर्ग ने भी स्व-रचित रूचिपूर्ण रचनाओं का पाठ किया तथा अहिन्दी भाषी प्रतियोगियों ने भी प्रतियोगिताओं में हिस्सा लिया और पुरस्कार प्राप्त किए।

14 सितम्बर 1993 को संस्थान में हिन्दी वार्षिकोत्सव के अवसर पर संस्थान के निदेशक डा. रमा कान्त पाण्डेय ने मुख्य अतिथि प्रो. प्रेम नारायण, डीन एवं संयुक्त निदेशक, मा. कु. अ. सं. का स्वागत किया। श्री अखिलेन्द्रपाल सिंह ने संस्थान में हुई विभिन्न हिन्दी गतिविधियों से अवगत कराते हुये वार्षिक रिपोर्ट प्रस्तुत की। तत्पश्चात् द्वितीय “डा. दरोगा सिंह व्याख्यानमाला” का आयोजन किया गया जिसके वक्ता प्रो. प्रेम नारायण, डीन एण्ड संयुक्त निदेशक (शिक्षा), मा. कु. अ. सं. ने “कृषि में सांख्यिकी की भूमिका” पर अपना एतिहासिक व्याख्यान दिया। उनका व्याख्यान सराहनीय था। व्याख्यान में तत्पश्चात् निदेशक डा. रमाकान्त पाण्डेय ने



प्रो० प्रेम नारायण, डीन एवं संयुक्त निदेशक (शिक्षा), भा० कृ० अं० सं०,
डा० दशरिगा सिंह स्मारक हिन्दी व्याख्यान देते हुए



हिन्दी में अधिकाधिक कार्य करने हेतु रख रखाव अनुमात्र के प्रभारी
श्री संतोष कुमार सिंह, सहायक अभियन्ता को चल-शील्ड
प्रदान करते हुए मुख्य अतिथि के
रूप में प्रो० प्रेम नारायण

प्रो. प्रेम नारायण को सम्मानित किया। साथ ही रत्न-रत्नाव अनुभाग को चल शील्ड भी मुख्य अतिथि ने अपने करकमलों से प्रदान की।

विभिन्न प्रतियोगिताओं के लगभग 60 से अधिक सफल प्रतियोगियों को मुख्य अतिथि प्रो. नारायण ने पुरस्कृत किया। संस्थान में हो रही हिन्दी कार्यों को प्रगति के लिये संस्थान के निदेशक एवं हिन्दी अन्भाग के कर्मचारियों को बधाई दी। हिन्दी के प्रति अपना प्रेम प्रदर्शित करते हुये मुख्य अतिथि ने कहा कि यह एक ऐसी भाषा है जो वैज्ञानिकों के संदेश को किसानों तक पहुंचाती है इसलिये हम सभी को सरकारी कामकाज में

हिन्दी का प्रयोग अपना नैतिक दायित्व समझते हुये करना चाहिये।

प्रतिवेदनाधीन वर्ष के दौरान राजभाषा कार्यान्वयन समिति की सभी बैठकें समयानुसार आयोजित हुई थीं उनमें अनेक महत्वपूर्ण निर्णय लिये गये तथा उन्हें लागू भी किया गया। गत वर्ष सबसे महत्वपूर्ण निर्णय हुआ कि क्रमबद्ध तरीके से संस्थान के संगणकों को द्विभाषी बनाया जाये। इस प्रकार गत वर्ष हिन्दी के प्रगामी प्रयोग में वृद्धि के लिये अत्यन्त ही महत्वपूर्ण रहा।

IASRI PERSONNEL

Dr OP Kathuria, Director

(w.e.f. 5-8-94)

**Division of Design of Experiments
and Analysis of Experimental Data**

Dr VK Gupta,
Sr. Scientist and Head

Principal Scientist

Dr PR Sreenath

Sr. Scientists/Scientists (SG)

Dr Basant Lal
Smt Asha Saxena
Shri RK Ghai
Shri JK Kapoor
Dr GC Chawla
Dr Ravindra Srivastava
Dr PK Batra
Shri KC Bhatnagar

Scientists

Smt Rajinder Kaur
Shri Onkar Swarup
Shri CH Rao
Shri DK Mehta
Shri GL Khurana
Shri MR Vats
Shri DK Sehgal

Shri Alope Lahiri
Shri NK Sharma
Smt Ajit Kaur Bhatia
Dr (Km) Seema Jaggi
Dr Rajendra Prasad

**Division of Sample Survey Methodology
and Analysis of Survey Data**

Dr HP Singh,
Principal Scientist and Head

Principal Scientists

Dr AK Srivastava
Dr PC Mehrotra
Dr Randhir Singh
Dr MG Mittal
Dr Shivtar Singh

Sr. Scientists/Scientists (SG)

Dr HVL Bathla
Dr BC Sexena
Shri SS Gupta
Shri Anand Prakash
Shri TB Jain
Dr SS Shastri
Dr NK Ohri
Shri RL Rustagi

Shri SN Arya
Shri MS Batra
Dr DL Ahuja
Shri KPS Nirman
Shri GS Bassi
Shri AS Gupta
Dr KK Tyagi
Shri RS Khatri

Scientists

Shri JP Goyal (Sr. Scale)
Shri HC Gupta (Sr. Scale)
Shri DC Mathur
Shri Mahander Singh
Shri RC Gola
Dr Jagbir Singh
Shri SC Agarwal
Shri DK Bhatia
Shri SC Sethi
Shri Bhagwan Dass
Shri MS Narang
Shri Satya Pal
Shri KK Kher
Shri T Rai
Shri VK Jain
Shri RM Sood
Shri K Chugh
Dr Anil Rai

**Division of Forecasting Techniques for
Crops, Diseases and Pests**

Dr OP Kathuria,
Principal Scientist and Head

Sr. Scientists/Scientists (SG)

Dr. (Smt) Ranjana Agrawal
Dr RC Jain
Shri GN Bahuguna
Dr Chandahas
Shri Jagmohan Singh

Scientists

Shri SC Mehta
Shri BH Singh
Shri SS Walia
Shri Madan Mohan

**Division of Bio-Statistics and
Statistical Genetics**

Dr BS Sharma
Principal Scientist and Head

Principal Scientist

Dr Prajneshu,

Sr. Scientists/Scientists (SG)

Dr VT Prabhakaran
Dr VK Bhatia
Shri SD Wahi
Shri Lal Chand
Dr SP Verma
Dr PS Rana

Scientists

Shri RK Jain
Shri Indra Singh

Division of Statistical Economics

Dr RK Pandey,
Principal Scientist and Head

Principal Scientist

Dr VK Sharma

Sr. Scientists/Scientist (SG)

Shri Shanti Sarup
Dr UN Dixit
Dr VK Mahajan

Scientists

Shri Ant Ram (Sr. Scale)

Shri SP Bhardwaj (Sr. Scale)
Shri Ashok Kumar
Smt Sushila Kaul
Dr SS Kutaula

Division of Computing Science

Shri SN Mathur,
Principal Scientist and Head

Principal Scientist

Shri R Gopalan

Sr. Scientists/Scientists (SG)

Dr IC Sethi
Shri Mahesh Kumar
Shri OP Dutta
Dr PK Malhotra
Shri KC Gupta
Dr RC Goyal

Scientists

Shri HO Aggarwal
Shri Balbir Singh

Coordination Cell

Shri TB Jain,
Scientist (SG) and Head

Training Administration Cell

Dr Randhir Singh, Professor (Ag. Stat)
and Head
Shri Mahesh Kumar, Professor (CAA)

Monitoring Cell

Dr PC Mehrotra,
Principal Scientist and Head

Technical Officers

Shri SK Suri, Field Officer (on leave)
Shri SD Sharma, Field Officer
Shri SS Srivastava, Librarian
Shri SK Sublania, MTO
Shri SK Mahajan
Shri DC Pant
Shri Amar Ranjan Paul, Sr Artist

Administration

Shri Chironji Lal, Chief Administrative
Officer
Shri JR Nirwal, Senior Administrative
Officer
Shri VR Srinivasan, Finance and
Accounts Officer

APPENDIX—II

SANCTIONED AND FILLED-UP POSTS

(As on 31-03-94)

S. No.	Designation	Scale of Pay (Rs.)	No. of Posts		No. of SC/ST Employees	
			Sanc-tioned	Filled	SC	ST
1	2	3	4	5	6	7
1.	Director	4500-7300	1	—	—	—
2.	Joint Director	4500-7300	1	—	—	—
3.	Principal Scientist	4500-7300	22	14	—	—
4.	Sr. Scientist	3700-5700	29	22	—	—
5.	Scientist (SG)	3700-5700	100	71	3	—
6.	Scientist	2200-4000				
7.	Experimental Scientist	1740-3000				
8.	Chief Admn Officer	3000-5000	1	1	1	—
9.	Sr. Admn Officer	3000-4500	1	1	1	—
10.	Finance and Accounts Officer	2200-4000	1	1	—	—
11.	Field Officer	2200-4000	3	2	—	—
12.	Mech Tab Officer	2200-4000	1	1	1	—
13.	Librarian (T-6)	2200-4000	2	1	—	—
14.	Tech Officer (T-6)	2200-4000	3	2	—	—
15.	Sr Artist (T-6)	2200-4000	1	1	—	—
16.	Asstt Field Officer (T-5)	2000-3500	1	1	—	—
17.	Asstt Engineer (T-5)	2000-3500	1	1	—	—

1	2	3	4	5	6	7
18.	Asstt Admn Officer	2000-3500	3	3	1	—
19.	Hindi Officer	2000-3500	1	—	—	—
20.	Security Officer*	2000-3500	1	—	—	—
21.	Artist (T-4)	1640-2900	1	1	—	—
22.	Superintendent	1640-2900	8	7	1	1
23.	Sr. Personal Asstt	1640-2900	1	1	—	—
24.	Photographer (T-II-3)	1400-2300	1	1	—	—
25.	Tech Asstt (Stat) (T-II-3)	1400-2300	163	121	18	1
26.	Tech Asstt (Eco) (T-II-3)	1400-2300	8	8	—	—
27.	Tech Asstt (Lib) (T-II-3)	1400-2300	2	2	—	—
28.	A.E.C. Operator (T-II-3)	1400-2300	6	3	—	—
29.	Field Inspector (T-II-3)	1400-2300	2	1	—	—
30.	Hindi Translator (T-II-3)	1400-2300	1	1	—	—
31.	Hindi Translator*	1400-2300	1	1	—	—
32.	Assistant	1400-2300	25	25	8	1
33.	Stenographer	1400-2600	11	11	1	—
34.	Jr Stenographer	1200-2040	18	11	2	—
35.	Sr Clerk	1200-2040	21	20	3	—
36.	Field Supervisor (T-2)	1200-2040	6	3	—	—
37.	Punch Supervisor (T-2)	1200-2040	3	3	1	—
38.	Card Librarian (T-2)	1200-2040	1	1	—	—
39.	Electrician (T-2)	975-1540	1	1	—	—
40.	Key Punch Operator (T-1)	975-1540	45	41	5	1
41.	Field Investigator (T-1)	975-1540	30	29	6	—
42.	Coders (T-1)	975-1540	10	3	—	—
43.	Reference Asstt (T-1)	975-1540	1	1	1	—
44.	Counter Asstt (T-1)	975-1540	1	1	—	—
45.	Telephone Operator (T-1)	975-1540	3	3	—	—
46.	Tubewell Operator (T-1)	975-1540	2	2	—	—
47.	Tubewell Operator*	950-1500	1	—	—	—

1	2	3	4	5	6	7
48.	Sr Gestetner-Operator*	950-1400	1	1	—	—
49.	Carpenter*	950-1400	1	1	—	—
50.	Driver (T-1)	975-1540	2	2	2	—
51.	Driver*	975-1400	4	2	—	—
52.	Zerox Operator*	950-1500	1	—	—	—
53.	Jr. Clerk	950-1500	38	30	6	1
54.	Jr. Gestt. Operator*	800-1150	1	—	—	—
55.	Supporting Staff					
	Grade—I	750-940	54	44	15	—
	Grade—II	775-1025	27	27	5	1
	Grade—III	800-1150	14	14	5	1
	Grade—IV	825-1200	7	7	5	1

* Auxiliary Post

APPENDIX—III

APPOINTMENTS, PROMOTIONS, TRANSFERS
RETIREMENTS AND RESIGNATIONS

Appointments

Name	Designation	Grade (Rs.)	w.e.f.
1. Shri Roop Singh	SS Grade-I	750-940	26.03.94
2. Sh Shyam Swaroop	SS Grade-I	750-940	26.03.94
3. Sh Budh Ram	SS Grade-I	750-940	26.03.94
4. Sh Dinesh Rai	SS Grade-I	750-940	26.03.94
5. Sh Devendra Kumar	SS Grade-I	750-940	28.03.94
6. Sh Raghubur Singh	SS Grade-I	750-940	28.03.94

Promotions

Name	Designation	Grade (Rs.)	w.e.f.
1. Sh BN Chakraborty	A.E.C.O.	1640-2900	01.01.93
2. Sh Bhavnesh Kumar	Tubewell Operator	1400-2300	01.01.93
3. Sh Khem Chand	K.P.O.	1400-2300	01.01.93
4. Sh RD Sharma	Coder	1200-2040	01.01.93
5. Sh Survir Singh	SS Grade III	800-1150	13.01.94
6. Sh Prem Singh Man	SS Grade III	800-1150	13.01.94
7. Sh Raj Nandan Mehtu	SS Grade-II	775-1025	13.01.94
8. Sh Chote Lal	SS Grade-II	775-1025	13.01.94

Transfers

(a) On transfer from other Institutes/ICAR

Name	Designation	Grade (Rs.)	From	Date of joining
1. Dr UC Sud	Sr Scientist	3700-5700	IARI	01.02.94
2. Sh Chironji Lal	CAO	3000-5000	ICAR	29.07.93
3. Sh VR Srinivasan	F & AO	2200-4000	ICAR	03.05.93

(b) On transfer from this Institute :

Name	Designation	Grade (Rs.)	Place of joining	Date of relieving
1. Sh GC Sharma	CAO	3000-5000	IVRI	29.07.93
2. Smt Sangita Duggal	F & AO	2200-4000	ICAR	03.05.93

Retirements

Name	Designation	Grade (Rs.)	Date of Retirement
1. Sh SD Bal	Tech. Officer	2000-3500	31.01.94
2. Sh SA Saiyed	Field Supervisor	1400-2300	31.08.93
3. Sh BJ Murpani	Field Investigator	1400-2300	31.01.94

Resignations

Name	Designation	Grade (Rs.)	Date of Resignation
1. Smt. Nidhi Pundhir	Tech. Asstt.	1400-2300	07.04.93
2. Sh Lila Ram	SS Grade-I	750-940	30.09.93

